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CITY OF HEMET
Seismic Safety and
Public Safety General
Plan Elements

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CITY OF HEMET
Seismic Safety and
Public Safety General
Plan Elements

[Hemet City Council]
City planning Hemet
Emerg. relief "
" " Earthquakes "

Prepared by
L Envicom Corporation
June, 1976

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RESOLUTION NO. 1681

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF HEMET, AMENDING THE GENERAL PLAN BY ADOPTING THE SEISMIC SAFETY/PUBLIC SAFETY ELEMENTS PURSUANT TO SECTION 65302 OF THE CALIFORNIA GOVERNMENT CODE AND CERTIFYING THE ENVIRONMENTAL ASSESSMENT.

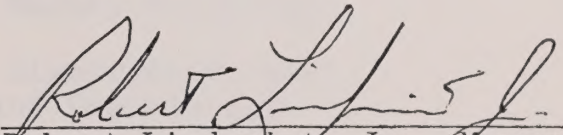
MOVED, PASSED AND ADOPTED at a regular meeting of said Council duly held the 11th day of May, 1976, by the following vote, to wit:

AYES: Councilmen Cozad, Kahn, Lindquist, Nishino.

NOES: Boyer.

ABSENT: None.

ABSTAIN: None.


Robert Lindquist, Jr., Mayor
CITY OF HEMET

ATTEST:

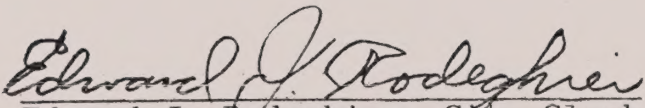

Edward J. Rodeghier, City Clerk
CITY OF HEMET

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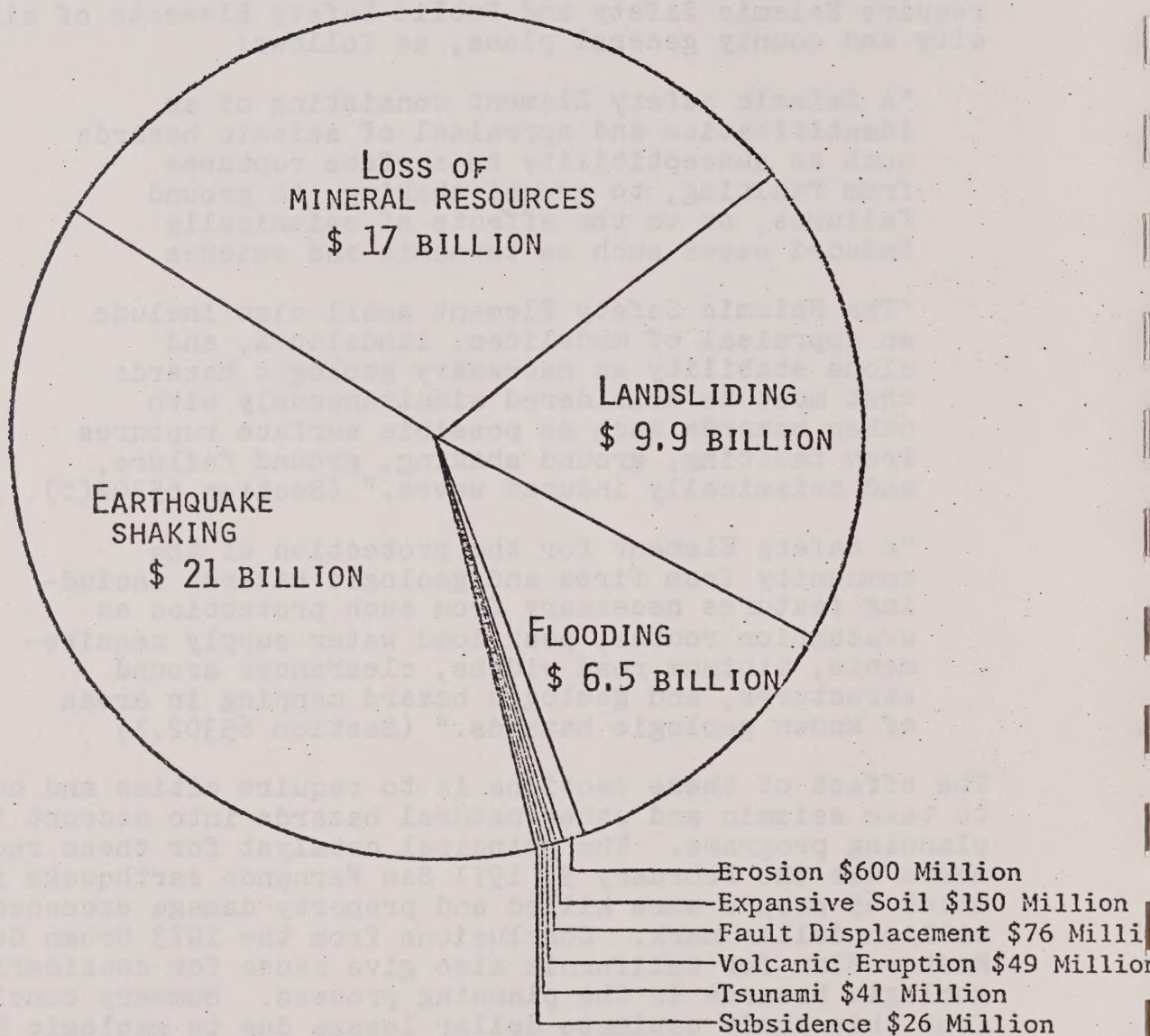
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GEOLOGIC HAZARDS IN CALIFORNIA

TO THE YEAR 2000:

A \$55 BILLION PROBLEM



Source: Urban Geology, Master Plan for California, Bulletin 198, 1973.

and counties and to recommend policies that would reduce the adverse impact of those hazards if they are realized. Specifically, these elements evaluate both primary and secondary seismic hazards, flooding, and [fire]. The intent of the recommended policies is to provide an opportunity to reduce the loss of life, property damage, and social and economic dislocations in the event of a major earthquake, flood, or [fire].

The purpose of this document is to serve as an official guide to the City Council, the Planning Commission and other governmental bodies, citizens, and private organizations concerned with natural hazards in the City of Hemet. The Seismic Safety and Safety Elements are intended to establish uniformity of policy and direction within the City government to minimize the risk from seismic events and other natural hazards. These Elements include goals, policies, safety criteria, and maps as a basis for decision-making in public and private development matters. Such information is to be used in conjunction with other established City policies contained in the General Plan, and should play a major role in determining future land use.

The Seismic Safety and Safety Elements have been prepared as two reports for the City of Hemet. The first is the County of Riverside Technical Report which contains a detailed presentation of the methods and findings regarding seismic, flood, and inundation hazards for the County as a whole. The second is this document which contains both a technical analysis of hazards at the local level (city-wide) as a supplement to the County report, and a recommended set of policies for hazard reduction.

The City of Hemet Policy Report is intended to implement the Geotechnical Report, which contains a detailed analysis of seismic, flood, and inundation hazards for the City of Hemet as well as the entire County of Riverside. There will be a need to update the Geotechnical Report frequently due to the ongoing emergence of new scientific data. Therefore, the Geotechnical Report will be maintained as a resource background document to support the Policy Report. Only the Policy Report will be adopted by resolution to the City of Hemet City Council to avoid frequent General Plan amendments to the Geotechnical Report.

It should be noted that the sciences of seismology and fire ecology are relatively young and that much remains to be learned. The basic philosophy under which this document was prepared is that we should incorporate natural hazards analysis into the planning process based on what we know today, rather than waiting until we know all that we would like to know.

II. EXISTING CONDITIONS

A. TYPES OF HAZARDS

Three basic groups of natural hazards are considered in this document: seismic, flooding, and fire hazards. There are several types of seismic hazards which can be grouped in a cause-and-effect classification that is the basis for the order of their consideration. Earthquakes originate as shock waves generated by movement along an active fault. The primary seismic hazards are ground shaking and the potential for ground rupture along the surface trace of the fault. Secondary seismic hazards result from the interaction of ground shaking with existing soil and bedrock conditions, and include liquefaction, settlement, landslides, tsunamis or "tidal waves", and seiches (oscillating waves in lakes and reservoirs).

The potentially-damaging natural events (hazards) discussed above may interace with man-made structures. If a structure is unabel to accommodate the natural event, failure will occur. The potential for such failure is termed a structural hazard, and includes not only structures themselves, but also the potential for damage or injury that could occur as the result of movement of loose or inadequately restrained objects within, on, or adjacent to a structure.

A more in-depth discussion of earthquake terminology and concepts is included in the Introduction of the Seismic Safety Element Technical Report, along with a Glossary of Terms in the back of the report.

Flooding hazards in this report are considered in two categories: natural flooding and dam inundation. Natural flooding hazards are those associated with major atmospheric events that result in the inundation of developed areas due to overflows of nearby stream courses, or inadequacies in local storm drain facilities.

Dam inundation hazards are those associated with the downstream inundation that would occur given a major structural failure in a nearby water impoundment.

B. TECHNICAL ANALYSES

1. Seismic Hazards

Geologic and Seismic Setting

The seismic setting of the City of Hemet and the developing area around it is dominated by the San Jacinto fault zone. Earthquakes originating on active faults within the zone caused considerable destruction in Hemet and nearby San Jacinto in 1899 and again in 1918 (see discussions of earthquakes in County technical report). The recurrence of earthquakes of this or possibly greater magnitude is the overriding consideration in the seismic safety of the Hemet area.

The geologic setting of the Hemet area is characterized by a broad, relatively flat alluvial valley from which steep mountains protrude somewhat like "islands" in a sea of sandy alluvium (Plate I). The mountains and hills are composed of granitic with some metamorphic rocks, with the exception of Park Hill which is composed of Pleistocene continental sediments. The alluvium southwest of the Casa Loma fault ranges from about 900 to 1500 feet thick with very rapid thinning at the edges of the bedrock mountains. The alluvium northeast of the Casa Loma fault is part of a down-faulted block in which Pleistocene and Recent alluvium and late Tertiary sediments are about 5000 to 7000 feet thick.

Active and Potentially Active Faults

The most significant seismic hazards in the Hemet area are the several active traces of the San Jacinto fault zone. They are not only the sites of potential ground rupture in the event of a large earthquake, but they are also the "centers" of most intense ground shaking should the earthquake occur as the result of slip of one of the faults.

The active and potentially active faults of the zone have been zoned by the State Geologist for Special Studies as required by the Alquist-Priolo Act. Since these Zones became effective in July, 1974, a number of geologic studies have been conducted to define the limits of geologic hazards on properties within the Zones. The studies reviewed as a part of this investigation are summarized in Appendix C of the County technical report, and the major results are shown on Plate I. Significant results that should be noted by the County Geologist in administering these zones are as follows:

1. The Casa Loma fault between Mayberry and Washington Avenues has been located in trenches as much as 600 feet southwest of its previously mapped location and very close to the edge of the study zone.

2. Numerous trenches have been excavated near Florida Avenue near the southeast end of a proposed fault bounding the southwest side of Park Hill with no faulting found.
3. Extensive trenching has also been completed near Florida Avenue across a trend of faulting along the northeast side of Park Hill and the Bautisto Wash area with no faulting encountered.

While the results of trenching to date is not as yet conclusive, the presence of faults bounding the northeast and southwest flanks of Park Hill, previously questioned by some geologists working in the area, is not being substantiated by detailed investigations. The County Geologist should, therefore, maintain a compilation of the results of trenching in the Study Zones in this area, and recommend appropriate modifications of the Zones to the State Geologist as soon as the level of information warrents.

Earthquake Shaking

Strong ground shaking accompanying earthquakes generated by slippage on the nearby San Jacinto or Casa Loma faults is probably the most important seismic/geologic hazard in the Hemet area. Qualitative evaluation of the intensity (Mercalli scale) of ground shaking during the larger, recent earthquakes (see County technical report) indicates that the Hemet-San Jacinto area has experienced ground shaking stronger than that which would be expected based only on the distance to the "center" of the earthquakes.

The stronger-than-normal shaking in this area is attributed to the presence of moderately shallow alluvium beneath most of the area. The concepts involved in the near-surface amplification of earthquake waves by relatively shallow alluvium are presented in detail in the technical report for the County, and are not repeated here. However, this effect is supported in theory and in the earthquake history of the City, and is considered an important seismic consideration.

The combining distance and site effects into a microzonation applicable to both the County generally and to the individual cities is developed in the technical report for the County. The resulting general characteristics of expected earthquake shaking applicable to the City are reproduced here in Table 1, and the referenced response spectra are included as Figures 1 through 7.

Secondary Hazards

Liquefaction is not a problem in the Hemet area because groundwater levels are in excess of 30 feet deep. Settlement, however, does appear to be a problem, at least locally, as severe settlement has been reported in at least two areas near Hemet. In his account of the 1899 San Jacinto earthquake, Claypole (1900) states:

TABLE 1.
GENERALIZED CHARACTERISTICS OF EXPECTED EARTHQUAKES
HEMET AREA

Use Category B					Use Cagtegrory C			
Zone	g	T	t	S	g	T	t	S
III A	0.54	0.1-0.2	15-20	1 x 1.25	0.43	0.1-0.2	10-15	1
III B	0.72	0.1-0.3	20-30	2 x 1.25	0.58	0.1-0.3	15-25	2
IV A	0.74	0.1-0.2	15-20	3 x 1.25	0.59	0.1-0.2	10-15	3
IV B	1.0	0.1-0.3	20-30	4 x 1.25	0.79	0.1-0.3	15-25	4
V A	0.94	0.1-0.2	15-20	5 x 1.25	0.75	0.1-0.2	10-15	5
V B	1.2	0.1-0.3	20-30	6 x 1.25	1.0	0.1-0.3	15-25	6
V C	0.63	0.2-0.4	30-40	7 x 1.25	0.5	0.2-0.4	25-35	7

Use Category D				
Zone	g	T	t	S
III A	0.27	0.1-0.2	8-12	1 x 0.64
III B	0.37	0.1-0.3	10-20	2 x 0.64
IV A	0.34	0.1-0.2	8-12	3 x 0.58
IV B	0.46	0.1-0.3	10-20	4 x 0.58
V A	0.35	0.1-0.2	8-12	5 x 0.46
V B	0.46	0.1-0.3	10-20	6 x 0.46
V C	0.23	0.2-0.4	15-25	7 x 0.46

g = Maximum ground acceleration expressed as a decimal fraction of the acceleration of gravity

T = Predominant period of ground shaking in seconds

t = Duration of "strong" shaking in seconds

S = Figure number for applicable response spectra and amplification factor for spectral values

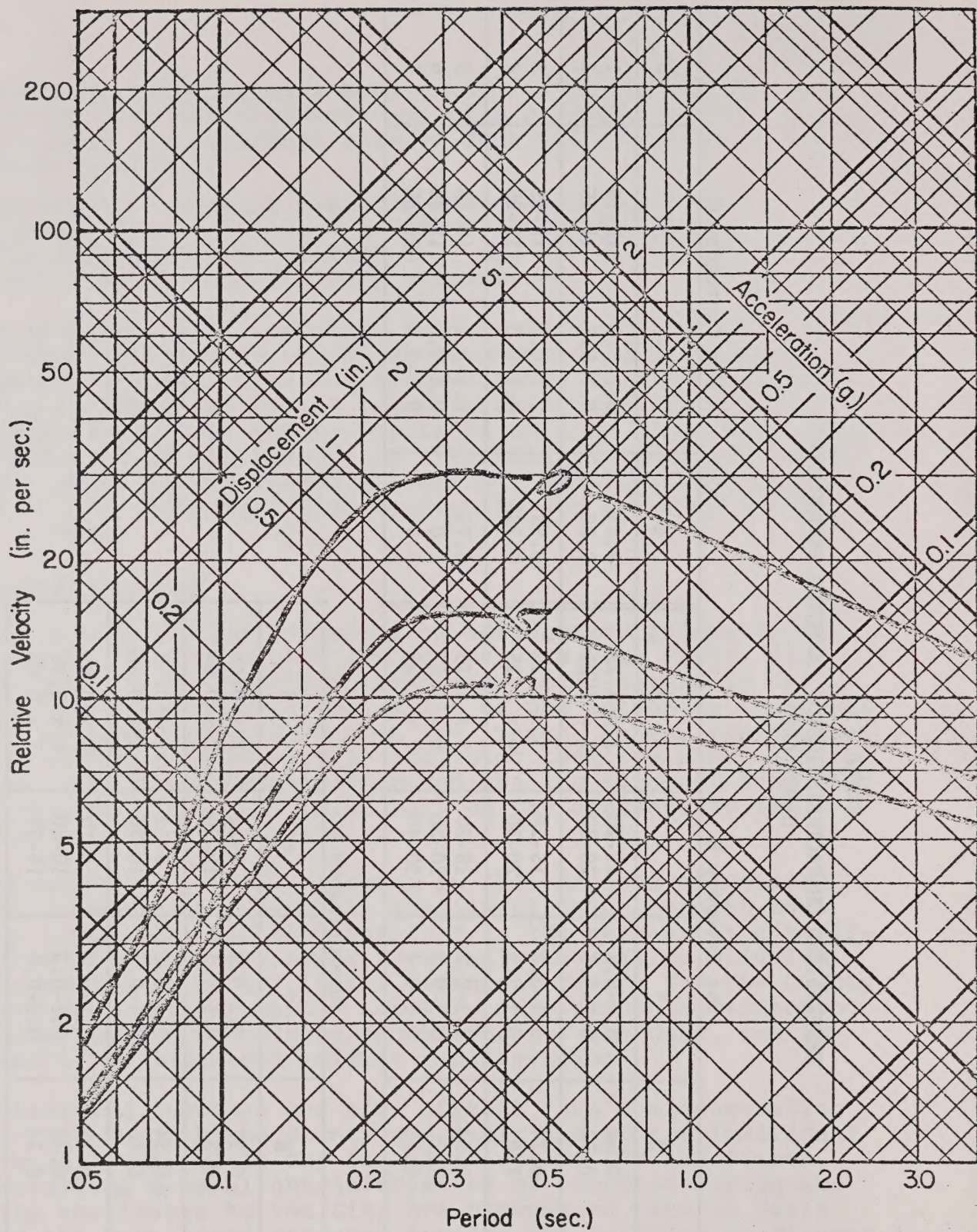


Figure 1. Response spectrum from Zone IIIA. Curves are for 0, 5, and 10% critical damping.

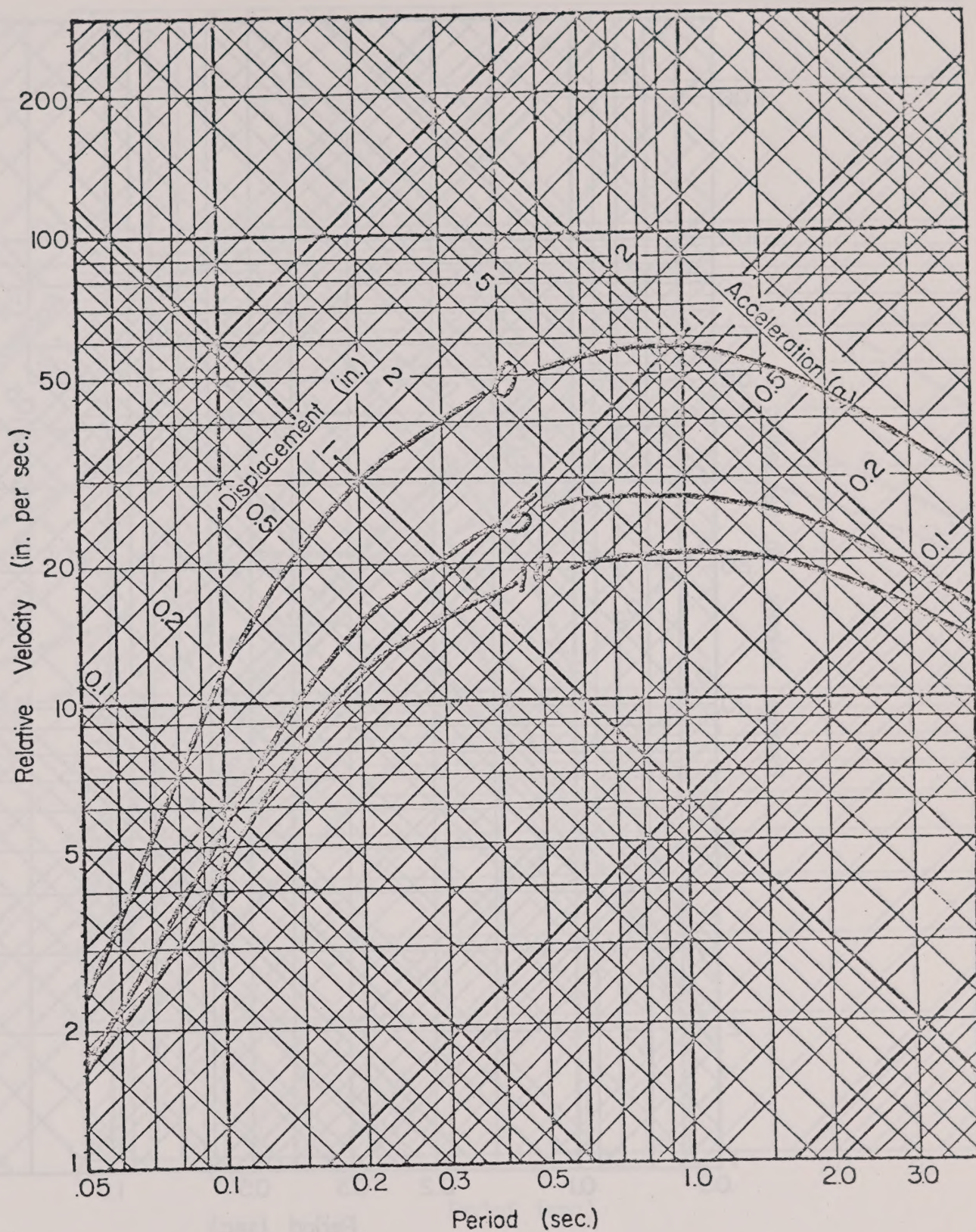


Figure 2. Response spectrum from Zone IIIB. Curves are for 0, 5, and 10% critical damping.

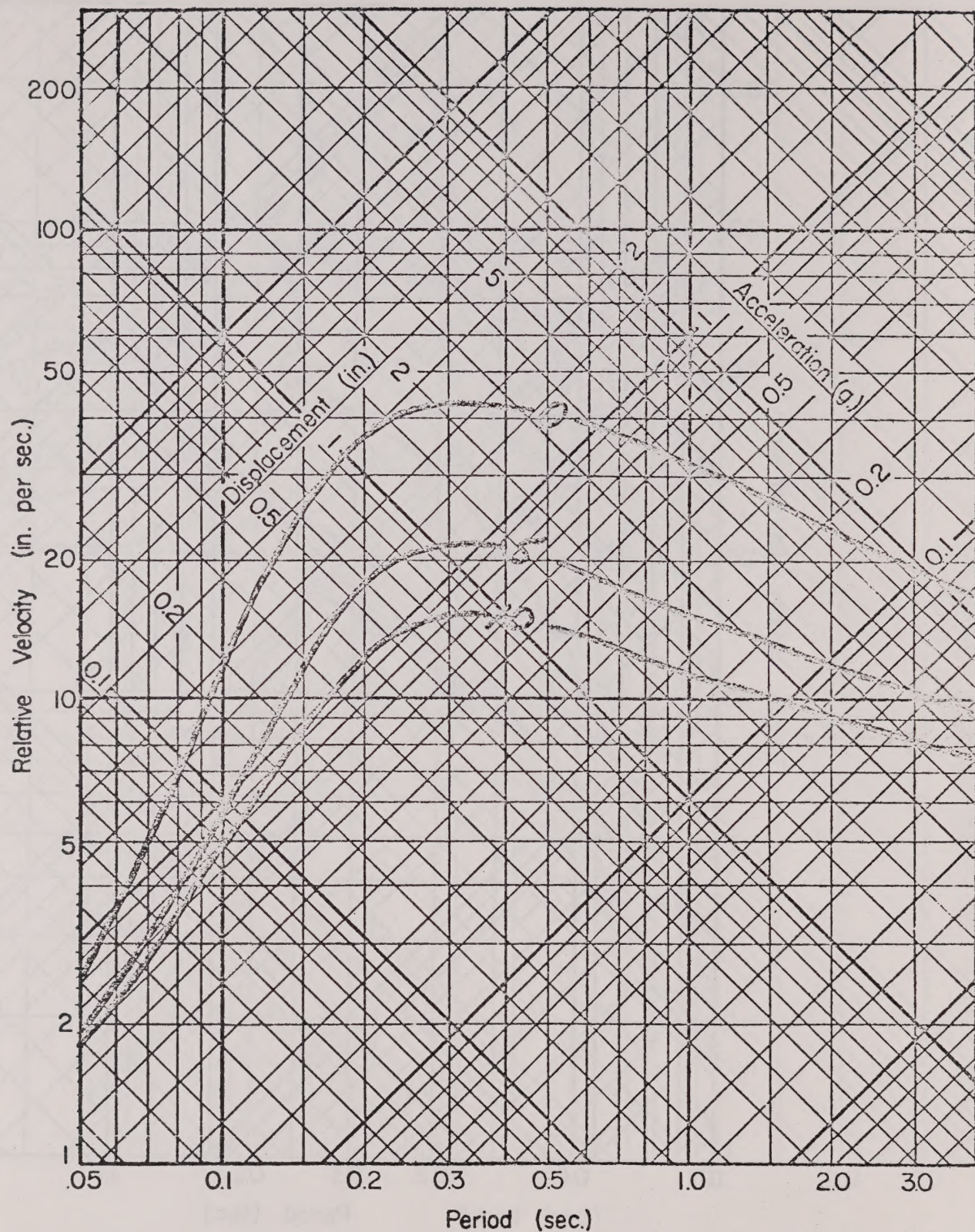


Figure 3. Response spectrum from Zone IVA. Curves are for 0, 5, and 10% critical damping.

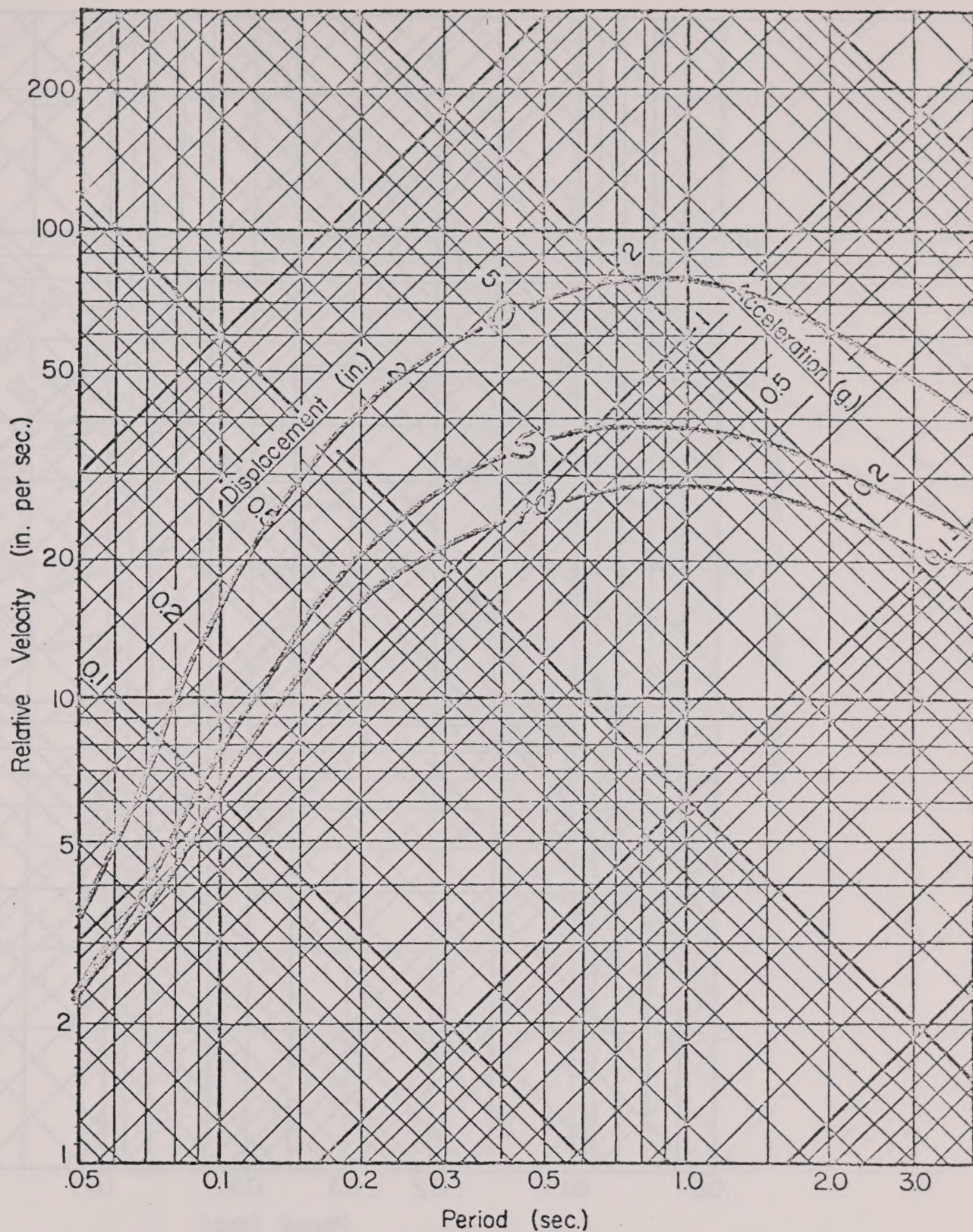


Figure 4. Response spectrum from Zone IVB. Curves are for 0, 5, and 10% critical damping.

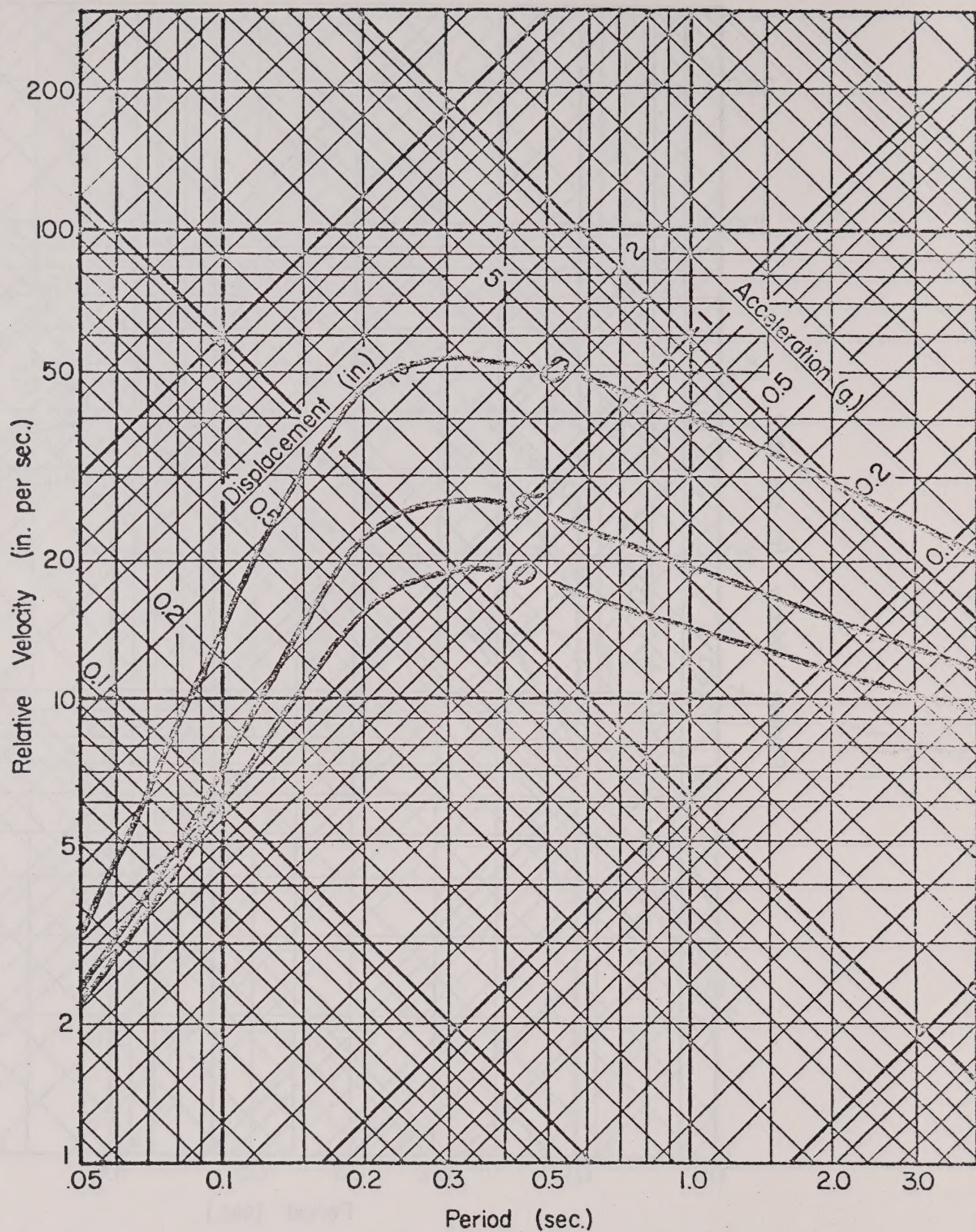


Figure 5. Response spectrum from Zone VA. Curves are for 0, 5, and 10% critical damping.

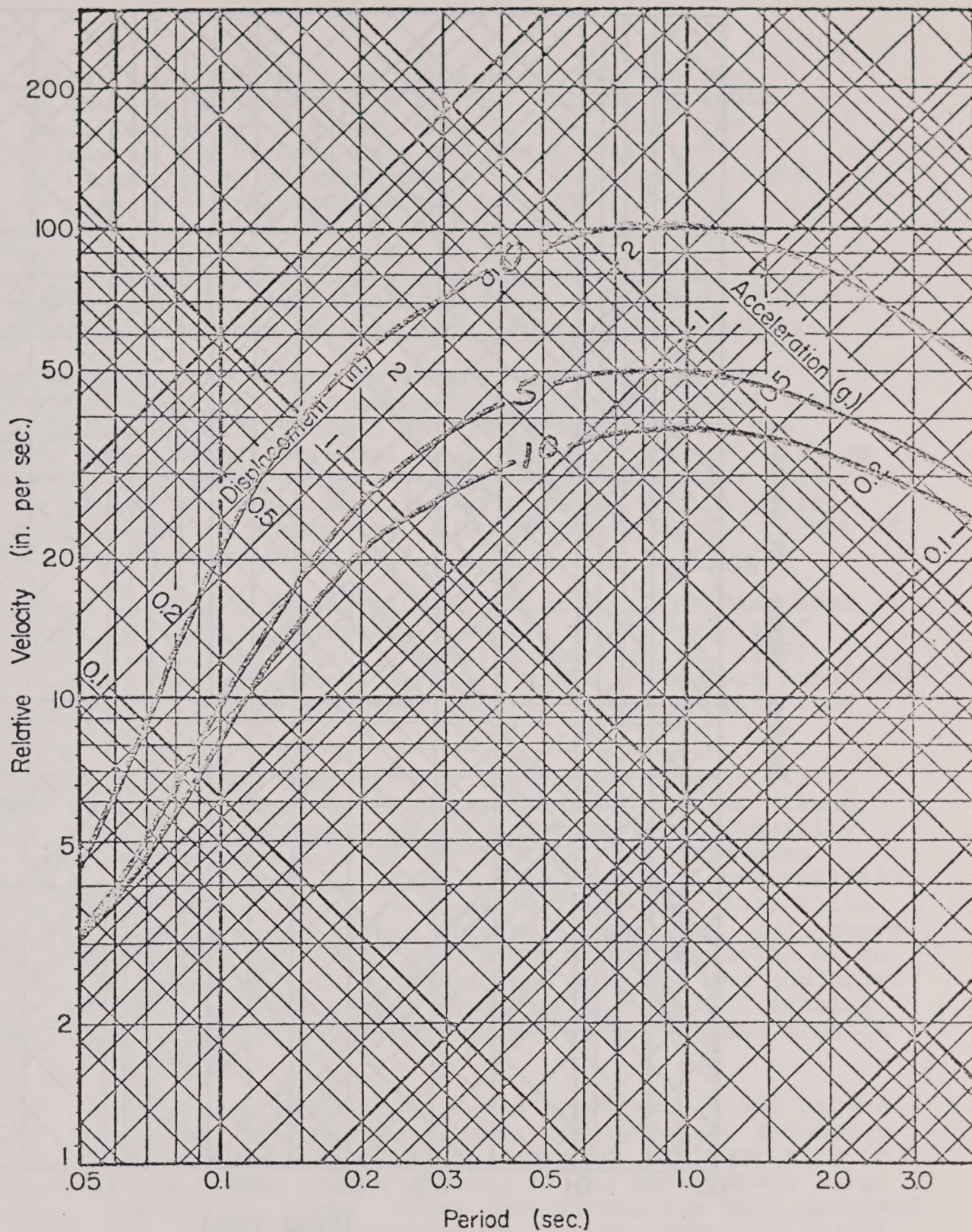


Figure 6. Response spectrum from Zone VB. Curves are for 0, 5, and 10% critical damping.

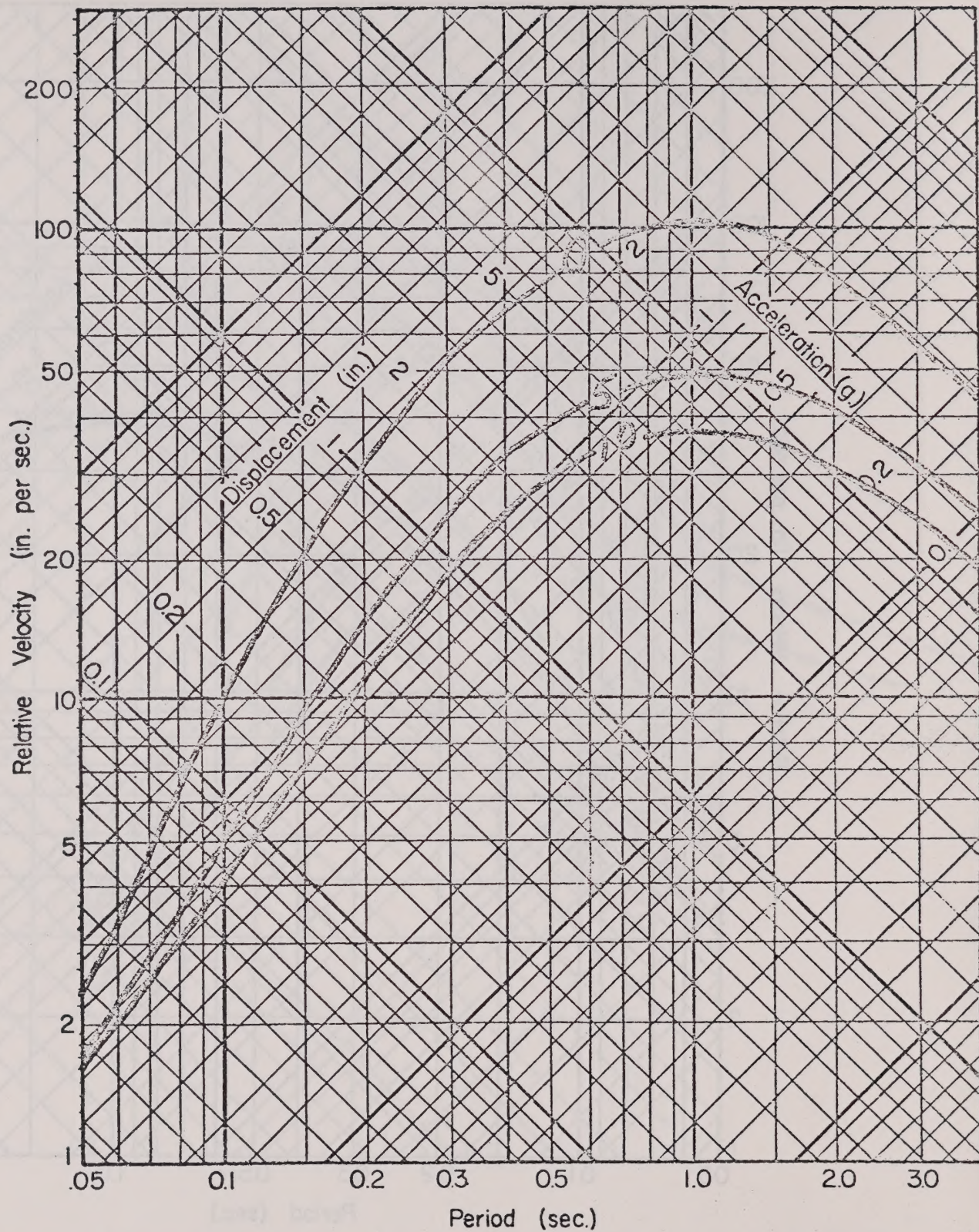


Figure 7. Response spectrum from Zone VC. Curves are for 0, 5, and 10% critical damping.

"About ten miles west of the town of San Jacinto, in the low hills near the extinct volcano of that name, land about a square mile in area sunk from thirty to one hundred feet and was greatly broken up by many deep and wide cracks. The sinking seems to have been progressive, continuing for two or three months, and not to have occurred at once."

While this account is probably exaggerated, it does indicate a potential for substantial differential settlement of poorly consolidated sediments in this area during strong shaking.

A similar situation exists in an area north of Lakeview where Fett, Hamilton and Fleming (1967) report aligned sink-holes and continuous cracks 5 to 15 feet wide and up to one-half mile long in parallel or en-echelon alignments along the margin of the San Jacinto Valley and the Lakeview reentrant. These features are not associated with active faults as is other settlement in the valley, but appears to be the result of a more widespread problem.

Settlement is also occurring along the trace of the Casa Loma fault as differential movement, probably as the result of groundwater withdrawal (Fett, Hamilton and Fleming, 1967). The movements are not associated with earthquakes, but considerable structural damage has occurred as a result of this type of settlement.

The problem of poorly compacted or improperly founded fills is only indirectly related to seismic hazards in that strong ground shaking may "trigger" an already existing instability. Such instabilities are just as likely, and often are more likely to be "triggered" by other events such as heavy rainfall. The proper solution to such problems is to require that fills be placed under the supervision of a soils engineer, and, where hillside terrain is involved, also under the supervision of an engineering geologist. In so doing, the engineer and geologist should take into account forces resulting from ground shaking as specified herein or as developed from more detailed studies of site conditions.

Landslides and slope instability are a relatively minor hazard in the Hemet area. The steeper slopes are underlain primarily by granitic rocks, and the downslope movement of loose rock or boulders during strong ground shaking is the most likely slope hazard in most of the area. Slope instability has been assessed using the methodology discussed in the County technical report based primarily on steepness of slope and rock type. Categories affecting the Hemet area are low to moderate risk on a scale of low to very high for all areas within the County. Were there areas rated on a scale applicable to all of California, they would more likely be rated very low to low as to their

instability. However, the potential for instability exists in all the hillside areas, and engineering geologic investigations should be required for developments in these areas.

Seiching

Seiching is not a significant hazard in the area except as it may affect water storage tanks on hillside locations above inhabited structures. No specific tanks have been identified as being a hazard, but tanks constructed in the future should be designed to take into account the levels of expected shaking at the applicable frequencies as defined by the spectra included in the main body of the technical report.

Conclusions and Recommendations

- Several "active" and "potentially active" faults of the San Jacinto fault zone are present within and near the Hemet area. These faults have been zoned for Special Studies as required by the Alquist-Priolo Special Studies Zones Act. Investigations conducted to date indicate that the fault traces may be in error by as much as 600 feet or may not exist at all. The County Geologist should maintain a compilation of the results of trenching in the area, and recommend appropriate modifications of the Zones to the State Geologist as the level of information warrents.
- Earthquake shaking is expected to be strong to severe as a result of movement on any one of several faults within the San Jacinto fault zone. The areal distribution of the zonation for ground shaking is shown on Plate I, and the general characteristics of expected shaking are summarized in Table 1. Applicable response spectra are referenced in the Table.
- Liquefaction is not a problem in the area because groundwater levels are below those normally considered to be conducive to this problem. However, substantial differential settlement as apparently occurred as a result of earthquake shaking and along the Casa Loma fault as a result of groundwater withdrawal. Soils engineers should be alert to this problem in conducting foundation investigations in this area.
- Slope instability problems are low to moderate in comparison to the County generally, and low in comparison to problems in some areas of California. However, the potential for instability exists in all the hillside areas, and engineering geologic investigations should be required for developments.
- Seiching may present a hazardous situation in water storage tanks on hillside locations above developed areas. No specific tanks have been identified as being hazardous, but tanks constructed in the future should be designed for the expected ground shaking as defined herein.

2. Flooding Hazards

Hydrologic Setting

The City of Hemet is located in the broad, low-lying San Jacinto Valley in western Riverside County. Mean elevation is approximately 1586 feet and average seasonal rainfall is approximately 10.85 inches (Troxell, 1948). Most of this rainfall occurs during the wetter months of winter and spring, as is characteristic of Mediterranean climates.

The Hemet area is drained by Salt Creek and its major tributaries, Hemet Channel, St. Johns Canyon Wash, Cactus Valley Wash and four unnamed washes. The Salt Creek watershed system comprises a total drainage area measuring approximately 128 square miles in size. The creek originates at the 4,500 feet level of Red Mountain and flows generally westward, through the City of Hemet. Salt Creek drains the flat, agriculturally-oriented valleys, and as such, much of the drainage has been obscured by agricultural practices.

The smaller size of the Salt Creek watershed along with the moisture-retentive nature of the local soils help minimize the exposure to flooding. However, flooding and subsequent ponding of waters in the very flat fields and valleys does occur. The following table shows the peak flows and total volumes conveyed by Salt Creek during periods of past flooding:

Table 2
Peak Flows and Volumes at
Salt Creek for Various Storm Periods

<u>Storm Period</u>	<u>Salt Creek</u>	
	<u>Peak Flow cfs.</u>	<u>Total Vol. (A.F.)</u>
3/7/58 - 4/16/58	280	1440
11/22/65 - /2/4/65	107	160
12/3/66 - 12/21/66	124	171
1/19/69 - 2/17/69	356	472
2/18/69 - 5/21/69	2011	5,834

(Taken from RCFCWCD, 1970)

Hazards Potential for Flooding

Flooding (Plate II)

Taken from: 1) Corps of Engineers (1971) Flood Plain Information for Salt Creek

2) HUD FIA Studies, 1974 City of Hemet

The Hemet area has experienced significant levels of flooding during periods of heavy runoff. The most extensive flooding has occurred along most of Salt Creek to the southwest of the downtown area. Published studies are not available that delineate the northerly limit of the Salt Creek Flood plain; however, the flat nature of the area indicates that spreading would be substantial.

The downtown Hemet area is protected by Hemet Channel, a six mile in length concrete storm channel that conveys water from the City to Salt Creek, near Patterson Avenue.

The Hemet area is also protected from flooding that would occur along Bautista Creek, a local tributary to the San Jacinto River, located to the east of the City. Bautista Creek Channel, a joint RCFCWCD-Corps of Engineers project, has a design flood capacity of 16,500 cfs and carries flood waters safely past the City of Hemet into the San Jacinto River (RCFCWCD, 1973).

Hazard Potential for Dam Inundation

The City of Hemet area would be partially inundated in the event of a complete collapse of Little Lake Dam at full capacity. The dam is an earth-fill facility that impounds approximately 90 acre-feet of water. Located southeast of the City in the Santa Rosa Hills, it is owned by the Lake Hemet Municipal Water District.

A failure of Little Lake Dam would result in an inundation pathway approximately 1000-2000 feet in width to the northeast of the City (Plate II). Approximately 200-240 minutes would be required for the initial flood wave to traverse the area adjacent to Hemet. Damages associated with inundation would be less than major, because of the limited amount of water impounded by the dam.

Inundation of a more substantial magnitude would be anticipated in the event of a failure of Lake Hemet Dam, located upstream, on the San Jacinto River. Although the City of Hemet would be largely unaffected by such an occurrence, the overall level of damage in the San Jacinto Valley would be extremely severe. For a more detailed description of the anticipated hazards re-

lative to a failure of the Lake Hemet Dam, please consult Section IV of the Public Safety Technical Report.

Conclusions

- Recent investigations by the Corps of Engineers indicate that 100-year floods along Salt Creek would breach the banks of the drainage and any existing measures designed for flood control purposes. As such, the City of Hemet is exposed to flooding in the areas near Salt Creek.
- Flooding in other portions of the Hemet area is not a major concern. Improvements along Bautista Creek and Hemet Channel appear to be adequate for storms approaching the 100-year level.
- The Hemet area is exposed to the risk of inundation from Little Lake. Although the likelihood of a dam failure is not great, the nature of this hazard is such that it should be considered.

3. Fire Hazard/Fire Protection

Introduction:

Government Code Section 65302.1 requires a safety element of all city and county general plans "for the protection of the community from fires . . . including features necessary for such protection as evacuation routes, peak load water supply requirements, minimum road widths, clearance around structures . . ." The objective of this general plan element is to summarize the fire safety situation in the City of Hemet and to develop long-range and short-range policies and implementation programs designed to minimize community risk, upgrade hazardous conditions, and insure proper future development. Toward that end, the following sections identify existing and potential fire hazards, analyze fire protection capabilities, and evaluate the effectiveness of fire fighting forces to combat existing and potential fire problems.

Existing Fire Situation:

Residential and commercial areas constitute the major consideration in determining fire potential in the City of Hemet because of the extensiveness of these two land uses. Many factors affect the fire hazard situation, such as the following: adequate comprehensive codes; effective code enforcement; a complete and integrated communications system; in-depth training; standardization of methods; mutual aid from adjoining agencies; rapid response times; and administrative coordination of all activities.

The City of Hemet Fire Department has indicated that the overall fire hazard in the City of Hemet as compared to other communities in this area is termed "moderate" within the three categories of "Severe", "Moderate", and "Minimal". Some concern is justified for a conflagration potential in certain residential areas due to a combination of factors such as high wind conditions, wood shingle roofs, and high concentration of structures. Additionally, some common fire hazards such as (1) misuse of storage areas for flammables in quantities not safely protected; (2) common attics and separations existing in some older commercial structures; (3) improper parking in alleys and roadways; and (4) restricted traffic flow within certain areas require further consideration when evaluating the City's

fire protection capabilities. Figure 9 illustrates the location of structural, vehicle, grass and trash fires during Fiscal Year 1974-75. Table 3 illustrates estimated fire loss for that same period.

A great amount of cooperation is involved in coordinating interdepartmental activities to insure Code compliance for all new developments. This cooperation that presently exists, enables proper types of fire protection to be required during preliminary planning and actual construction. Additionally, all commercial and industrial occupancy changes or new facilities developed are inspected to insure that adequate fire protection is provided for the type of use intended in accordance with applicable fire code requirements and specifications.

High Value Areas:

High value areas such as the City's principal business districts, areas where bulk storage of flammable liquids exists, and residential areas subject to conflagration are illustrated in Figure 8. All of these areas require immediate fire control forces if fire loss is to be kept within acceptable limits. In addition to individual loss to property owners and potential loss of lives, loss of these types of occupancies has a large financial impact on the community in terms of property taxes, sales revenue, employment, and convenience.

To assist in minimizing such special fire potentials, the City has adopted the Uniform Building Code, the Uniform Fire Code, the National Fire Codes, sprinkler requirements in conjunction with the adopted codes, automatic fire extinguishing systems in certain restaurant classifications, and other fire protective requirements.

Conflagration Potential:

A conflagration is so termed when a fire becomes widespread and crosses natural or prepared barriers, i.e., streets, fire walls, or prepared fire breaks. Fires in large complexes, although fire loss may be considerable, are not necessarily conflagrations unless a fire extends beyond the perimeters of the complex.

Two potential conflagration areas exist in residential areas due primarily to the horizontal fire spread potential due to minimal fire separations, high wind conditions, wood shingle roofs, and concentration of structures (See Figure 8).

TABLE 3
FIRES/74/75-FISCAL YEAR

TYPE OF FIRE	LOCATION	ESTIMATED LOSS	INJURIES
Structure Fire	1875 E. Devonshire Avenue	\$ 2,100.00	
Structure Fire/MobileH.	1445 West Florida Avenue	75.00	
Structure Fire	37469 Harrison Avenue	2,000.00	
Structure Fire	141 Mary Lane	-0-	
Structure Fire	111 West Central Avenue	50.00	
Structure Fire	213 W. Latham Avenue	350.00	
Structure Fire	574 Westmont Avenue	-0-	
Structure Fire	412-1/2 North Franklin Street	250.00	
Structure Fire	1116 E. Latham Ave. (Hemet V. Hosp.)	-0-	
Structure Fire	210 N. Juanita Street (Hemet P.D.)	-0-	
Structure Fire	1116 E. Latham Ave. (Hemet V. Hosp.)	-0-	
Structure Fire	241 South Harvard Street	2,500.00	
Structure Fire	278 North Elk Street	4,200.00	
Structure Fire	1116 E. Latham Ave. (Hemt V. Hosp.)	-0-	
Structure Fire	700 East Madden Street	175.00	
Structure Fire	222 North Alessandro Street	1,600.00	
Structure Fire	1455 South State Street, Space #137	100.00	
Structure Fire	120 W. Latham Avenue, Apartment #4	-0-	
Structure Fire	120 South Franklin Street	-0-	
Structure Fire	1015 E. Acacia Avenue	600.00	
Travel Trailer	210 W. Kimball Avenue, Space #2	50.00	(1) Yes Citizen
Structure Fire	830 S. Alessandro Street	500.00	(Death)
Structure Fire	212 N. Elk Street	1,200.00	
Structure Fire/MobileH.	1711 San Andres Drive, Hemet	18,500.00	(1) Yes Citizen
Trash Fire	Alpha Beta Shopping Center (E/Florida)	200.00	
Structure Fire	127 North State Street	-0-	
Structure Fire/Shed	S/S Across From 26690 Harrison Avenue	500.00	
Structure Fire/Telev.	241 Val Monte Drive	850.00	
TOTAL ESTIMATED COST:		\$35,800.00	

Other Fire Hazards:

Other areas and uses in the City that create unique fire potential are above ground bulk storage of flammable liquids. These three areas are denoted on Figure 8. These areas have been located, identified, and safeguards taken to minimize hazards. Additionally, areas with existing structural deficiencies are denoted on Figure 8. As occupancies change or new facilities are developed, these areas are inspected to insure that adequate fire protection is provided for the type of proposed use.

Facilities that house non-ambulatory or restrained people, i.e., hospitals, rest homes, retirement homes, have also been identified on Figure 8. Special monitoring considerations have been given to protection of these areas and their unique situation.

Fire Control Capabilities:

The Fire Department has the capability of combatting most normal fire potentials, however, is not adequately manned for major or large area fires. Few cities can afford full fire combat forces necessary to meet all fire threats. Major or large area fires have not been frequent within the City. During a major fire within the City, the Fire Department will utilize the fire mutual aid plan with the Riverside County Fire Department for additional fire combat forces and equipment.

Fire Control Facilities:

The Hemet Fire Department operates from two (2) fire stations. Fire Station #1, located at 220 North Juanita Street; Fire Station #2 located at 895 West Stetson Avenue.

Of prime importance to the adequacy of the fire protection coverage is response time which is basically a function of the distance from the fire station to the incident location and the average speed of travel by fire apparatus. The distance from the fire station to the incident location cannot be straight line travel but must be the actual travel distance. The response time element is affected by the type of street facility over which the response is made and by the amount of traffic. Fire stations should be located so as to provide an average response time of five (5) minutes or less.

Upon notification of a fire within the City, both fire stations are immediately dispatched, one triple combination pumper from Fire Station #1, and one (1) pumper from Fire Station #2. Under normal conditions, this will assure (1) pumper company at the fire scene within five (5) minutes or less.

The Fire Department operates two (2) first line triple combination pumpers and one (1) first line rescue unit. There are in reserve, two (2) triple combination pumpers and (1) rescue unit, one (1) utility pickup truck with a small pump and water tank and one (1) utility pickup truck (fuel carrier) and two (2) staff vehicles.

Manpower:

Manning practices are normally based on a City's financial capability rather than the fire hazard potential. The average work week for firefighters is sixty (60) hours. The minimum manning level established for the department is four (4) men per shift at Fire Station #1 and three (3) men per shift at Fire Station #2. Two (2) of the four firefighters at Fire Station #1 also operate the rescue vehicle. The Fire Chief or Assistant Fire Chief are subject to emergency calls throughout the year, therefore, assuring a Chief Officer on duty or on call at all times.

Water Supply for Fire Protection:

The water required for fire protection use is supplied from three (3) sources: the City water system; Eastern Municipal Water District; and Lake Hemet Municipal Water District. The City water system has a total of four (4) water wells located within the City and they will produce a total of approximately 3,625 GPM. The City water system may receive additional water supply from the Eastern Municipal Water District by water valve controls located at Oakland Avenue and Park Avenue; this will add approximately 2,000 GPM to the City system. Lake Hemet Municipal Water District is also connected to the City water system by valve controls located at Johnston Avenue and San Jacinto Streets, also Johnston and Santa Fe Avenue. This will add approximately 1,000 GPM to the City water system. Refer to Figure 10 for these locations, "Water Reservoir and Wells".

The average daily water consumption in the City is approximately four (4) million gallons per day. The required fire flow is the rate of flow in gallons per minute needed for fire fighting purposes to confine and control a major fire to

a building or physical confines of the area. Greater fire flows may be required for structures or developments which present additional hazard potential; such as, building heights, exposures, minimum fire protection facilities, and hazardous process occupancies. Fire flow requirements throughout the City are a standard requirement by land use varying from 1,500 GPM in residential developments to a possible maximum required fire flow of 4,000 GPM to 6,000 GPM in the high hazard and industrial areas. All supplemental fire protection systems may include, but are not limited to, fire hydrants, automatic sprinkler systems, and other related systems and appliances as required for a development as may be deemed necessary to provide life and property protection, shall be the responsibility of the Fire Department. The maximum required residual pressure of twenty (20) PSI shall remain in the underground water system with the required GPM flowing. Refer to Figure 11, "Fire Flows".

The City also has three (3) water storage reservoirs (above ground) presently in operation. Reservoir Number One contains a storage capacity of 1.5 MG, Reservoir Number Two contains 1.25 MG. Both reservoirs are located at Oakland Avenue and Park Avenue, at an elevation of 1738 feet. Reservoir Number Three contains a storage capacity of 1.5 MG located east of South State Street in the 1700 Block at an elevation of 1737.5 feet. (Figure 10).

Emergency First Aid:

Emergency first aid services are provided to all citizens of the City of Hemet. This function is integrated into the fire protection system. All requests for emergency first aid are handled by the rescue company; however, should the rescue company not be available, the closest fire company would be dispatched to said emergency. Transportation of the injured or sick persons is handled by the local ambulance company.

Emergency Rescue:

Rescue services are also integrated into the fire protection system. All trapped victims receive extraction services from the closest available fire station or engine company. Light rescue can normally be performed by the engine company in conjunction with the rescue unit. Heavy rescues such as collapsed buildings, etcetera, may also require response of specialized equipment from the Public

Works Department or private contractors. Procedures are established to secure the response of this special equipment.

Police Services:

Many of the fires, first aid calls or rescues require the coordinated support from the Hemet Police Department. Police personnel provide continuous fire watch service throughout the City, and reporting of incidents are normally handled through the local police and fire radio system. The Police also perform traffic and crowd control at all emergency incidents. For all incidents involving a crime, the police immediately assume command of that portion of the emergency. Arson and incendiary fire cause investigations are normally handled by police and fire department investigation teams.

Disaster Preparedness:

Major emergencies or disasters require the activation of the City's emergency operations plan that provides for a direction and control staff functioning at the primary emergency operating center located in the Police Department Building located at 210 North Juanita Street. In the event the primary center is not habitable, the operating staff will form and function from an alternate facility located at the Administrative Building at the Farmers Fairgrounds located at 100 South Palm Avenue.

Upon declaration of a local emergency, by duly constituted authority, or declaration of a state of emergency by the governor of California, the organization of City Government is changed to provide the extraordinary powers necessary to respond expeditiously to the emergency. The City Manager will assume the role of Emergency Corps Commander; in his absence a line of succession has been established. All City emergency resources are immediately placed under the command of the Emergency Corps Commander. In accordance with local, state and federal statutes, the Emergency Corps Commander will be responsible for all operations within the City and for coordination/response to lateral and higher authorities.

Emergency Communications:

The fire operating and dispatch center is located at Fire Station Number One located at 220 North Juanita Street.

Emergency calls are received at this location, generally by local telephone.

The City does not operate a street fire alarm box reporting system. The Fire and Police Department's operate from one (1) combined radio frequency with capabilities to utilize the local Public Works net should failure occur on the main Fire and Police Frequency. All fire apparatus and staff vehicles are radio-equipped with four (4) frequency capabilities including a State Mutual Aid Fire Net and Riverside County Fire Net. Staff communications at the scene of emergencies are capable by the utilization of hand-held portable radios.

This operation of the combined Police and Fire Radio Frequency System has proven satisfactory with advantages for both departments. During extreme radio traffic loads, the Fire Department has the capabilities of utilizing other fire nets, thereby reducing the radio traffic on the combined Fire and Police Net.

Fire Mutual Aid:

A Reciprocal fire mutual aid plan is in effect with the Riverside County Fire Department and the Hemet Fire Department. This mutual aid plan is not automatic, the entity desiring aid normally requests through their dispatching center. Due to numerous brush fires within the County during the dry season, mutual aid to the City may be limited.

Fire Prevention:

Applicable code enforcement, fire investigation, public relations, fire and life safety educational programs for the general public, school staff and students, general hospital, and convalescent hospital employees, the maintaining of written records is the responsibility of the Bureau of Fire Prevention.

Fire prevention is based upon knowledge of fire and building codes, what can burn, locations, source and ignition causes. Thorough and prompt investigation of a fire cause is one of the principal successes of any fire prevention function with accurate ignition information obtained.

Fire prevention programs are planned and placed in effect with actual field inspection production and problems

encountered closely monitored. Expertise is provided to the fire suppression companies on code interpretation. The majority of occupancies are inspected at least once annually with certain facilities inspected quarterly by either the Fire Prevention Bureau or Fire Suppression Companies. A hazardous weed abatement program is conducted by the Bureau and is in effect throughout the year.

The Fire Prevention Bureau checks all construction plans including some dwellings to determine compliance with applicable fire and life safety codes. The Bureau works closely with other City departments to assist the developer in providing adequate fire protection to their structures. Code enforcement for existing occupancies, the recommended code changes and assisting the Fire Chief with future fire problems is the responsibility of the Fire Prevention Bureau.

Occupancies with large life loss potential are inspected periodically which at times is on a bi-monthly schedule with "in service" training for those personnel responsible, supervised by a Fire Prevention Officer.

Fire Prevention Personnel are subject to immediate response to combat fires when on duty and also off duty unless they are checked out of the jurisdictional area.

The Fire Prevention Bureau supplies fire safety information to civic, private organizations and citizens upon request.

A Fire Prevention Bureau investigates the causes of fire ignition and pursues for the prevention of recurrence.

The Fire Prevention Bureau is also charged with the responsibility for the follow-up on all arson and incendiary fires. Arson and incendiary fire cause investigations are normally conducted by Police and Fire Department Investigation Teams.

Manufacturing processes using hazardous materials or methods are evaluated to either reduce or eliminate the condition via the provision of adequate protection to prevent life and property loss.

The efforts of the Fire Prevention Bureau has contributed to a very low loss of life and property within the City of Hemet, and these efforts will continue with emphasis on additional improvements.

Future Recommendations:

As previously indicated, the Fire Department has the capability to meet and control most normal fire situations. As additional growth and density become reality, the Department will experience increasing demands.

In order to minimize life loss potential and fire loss for the future growth of the City, the following recommendations are offered by the Fire Department.

1. Fire Combat Training Center

A manipulative training area should be established within the City for combat drills such as live fire fighting, multi-engine company hose and ladder evolutions, etcetera. Fire Department training areas should be located as remote as possible from residential and commercial areas within the city.

A testing and drafting reservoir for pumper testing and training of pump operators should be incorporated as part of the training center.

2. Future Fire Sub-Stations

As population and development increases in the north and southwest areas of the City, consideration for the locations of fire sub-stations should be studied and evaluated.

3. Fire Prevention

The Fire Prevention Bureau should be upgraded by additional fire prevention specialist to cope with the growing demand for plan checking facilities, added technical inspections, fire and life safety programs for the general public, weed abatement enforcement, etcetera.

FIGURE 8

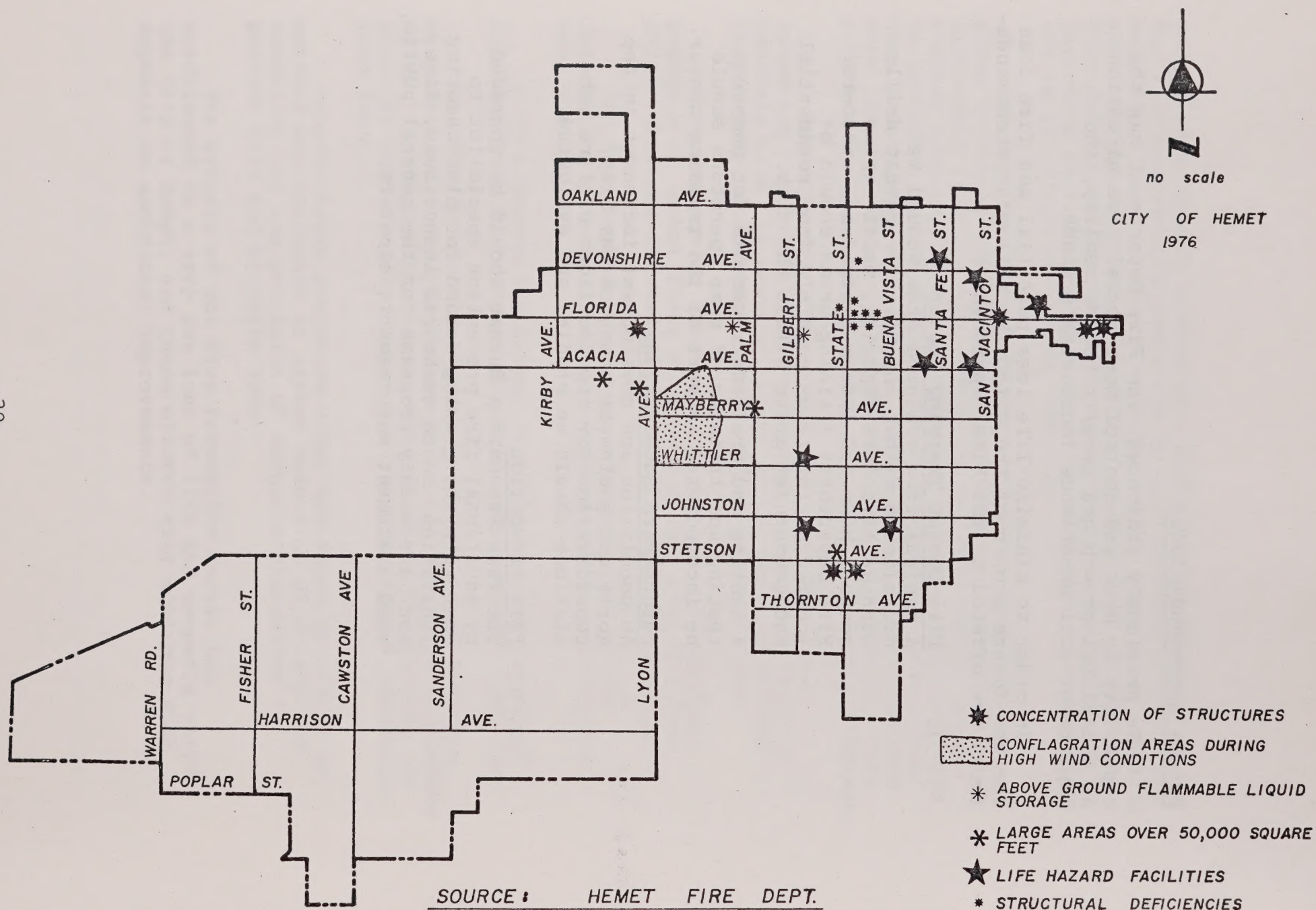
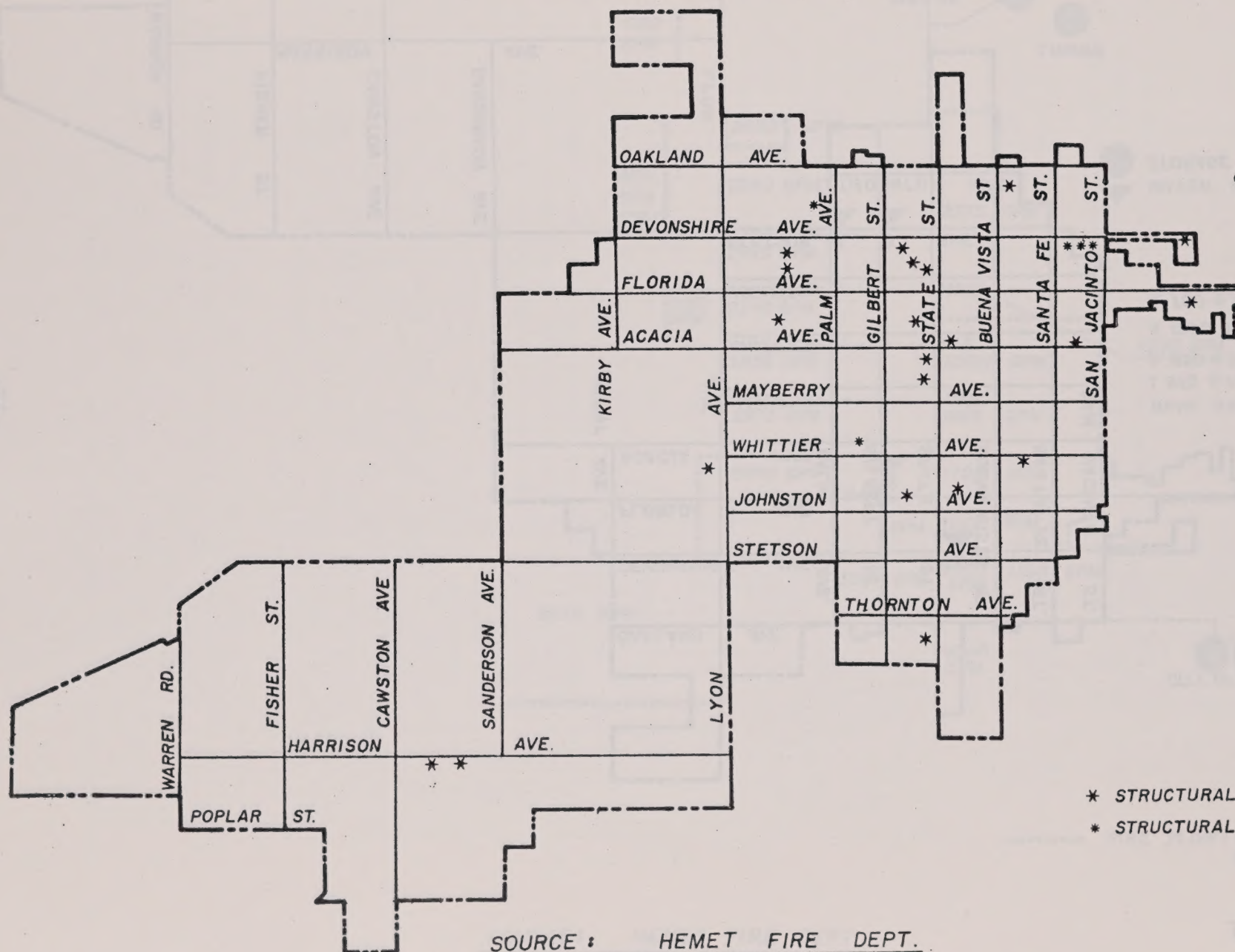


FIGURE 9



no scale

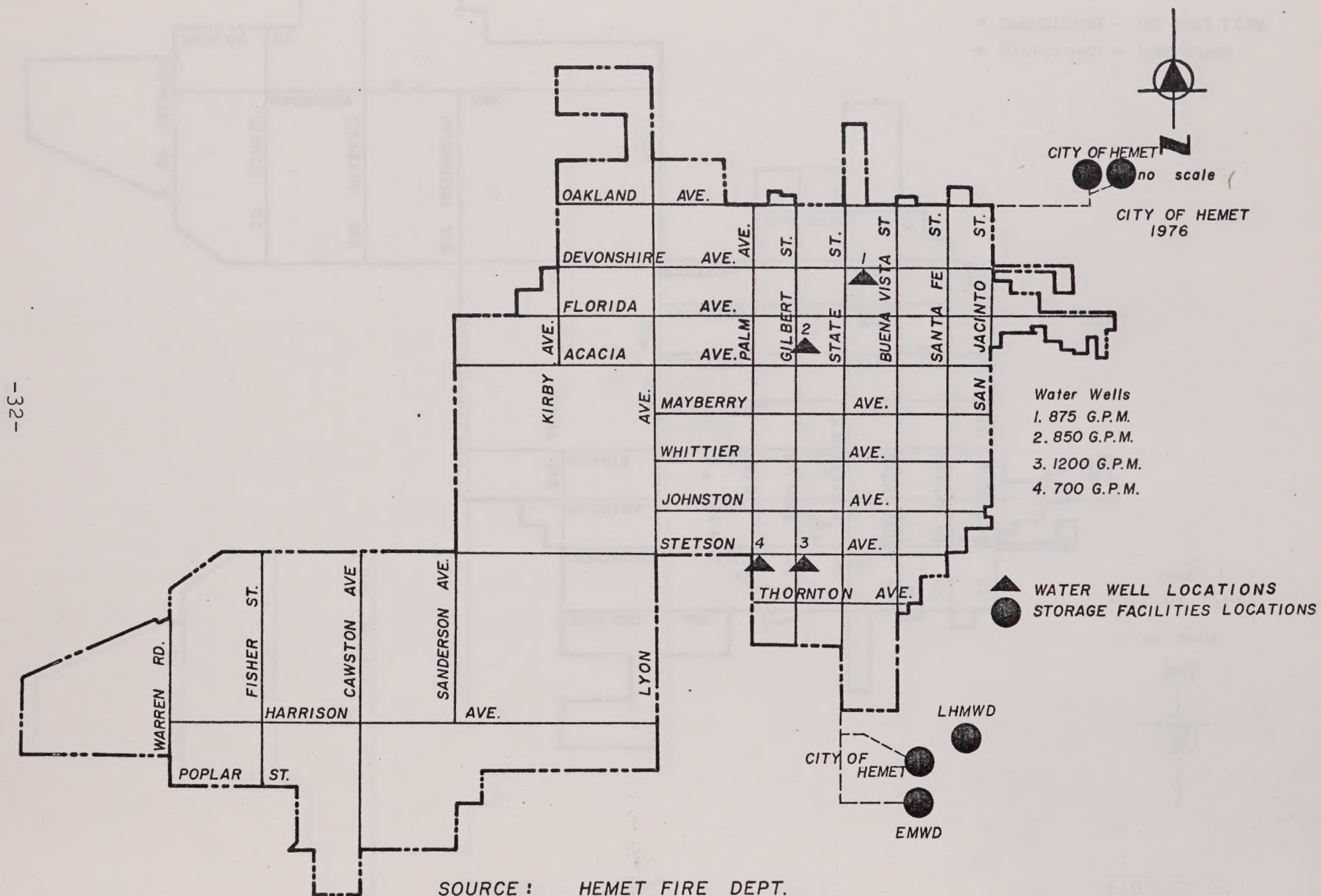
CITY OF HEMET
1976



- * STRUCTURAL - FIRE LOSS
- * STRUCTURAL - NO FIRE LOSS

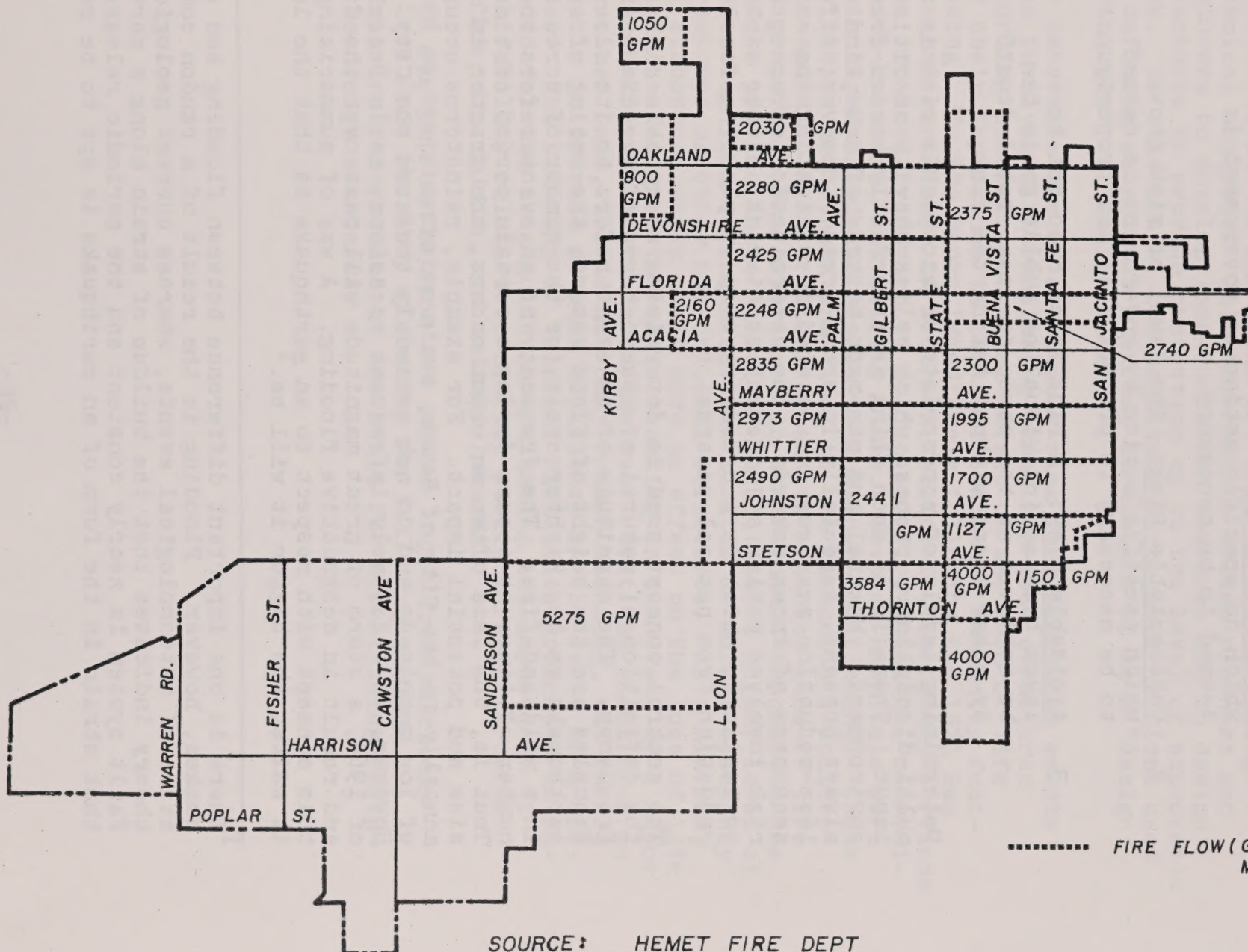
SOURCE : HEMET FIRE DEPT.

FIGURE 10





no scale
CITY OF HEMET
1976



..... FIRE FLOW (G.P.M. = GALLONS PER MINUTE)

SOURCE: HEMET FIRE DEPT

C. RISK

The Council on Intergovernmental Relations (CIR) defines "Risk" from natural and man-made hazards in three categories:

1. Acceptable Risk: The level of risk below which no specific action by government is deemed to be necessary.
2. Unacceptable Risk: The level of risk above which specific action by government is deemed to be necessary to protect life and property.
3. Avoidable Risk: A risk which need not be taken because individual or public goals can be achieved at the same, or less, total "cost" by other means without taking the risk.

Determining levels of appropriate or acceptable risk is a multi-disciplinary process which relies heavily on citizen input. There is no such thing as a perfectly hazard-free environment. Natural and man-made hazards of some kind are always present, especially in urban areas. However, effective loss-reduction measures can be used in mitigating the consequences of known hazards. The determination of acceptable risk involves making a judgement about risk, either explicit or implicit, which is a necessary step in planning for loss-reduction from natural hazards.

The central concept used in determining acceptable risk is the definition of natural events in terms of magnitude and frequency. The magnitude of an event refers to its size. Examples are the height of flood waters, the rating of an earthquake on the Richter scale, or the number of acres burned in a wildland fire. The frequency of an event refers to the number of times it occurs during a certain period of time. That is, the less often an event occurs, the greater is its size and potential impact. For example, rainstorms occur annually in the City of Hemet, but most often they are of low magnitude and do not seriously threaten the City. However, on relatively infrequent occasions, as in December of 1964, a storm of great magnitude will pass over the City and result in destructive flooding. A way of summarizing this concept with respect to an earthquake is that the longer it waits, the bigger it will be.¹

¹There is one important difference between flooding and earthquakes, however. Flooding is the result of a random combination of meteorological events, whereas current geologic theory indicates that the buildup of strain along a particular fault system is nearly constant and the periodic release of that strain in the form of an earthquake is apt to be regular.

The magnitude-frequency concept is involved in the decisions regarding acceptable risk in that the community must judge what magnitude event should be planned for. That judgment is based on the frequency or recurrence interval of the hazardous event. A description of the magnitude and other characteristics of the event are then developed through a technical analysis. This information allows planners and engineers to develop loss-reduction measures and to design structures to provide protection up to the level of acceptable risk. In this sense, the magnitude earthquake or flood used in defining acceptable risk may be thought of as a "design earthquake" or "design flood."

The determination of acceptable risk from hazardous events also involves differentiating among man-made structures according to their potential effect on the loss of life and their importance in terms of continued community functioning. In the hours immediately following the 1971 San Fernando earthquake in Southern California, emergency services were impaired by damage to police and fire stations, communication networks, and utility lines. Several hospitals were seriously damaged and unable to continue functioning. These facilities and others are vital to the community's ability to respond to a major disaster and to minimize loss of life and property. The experience in San Fernando emphasized the need to provide these "critical facilities" a higher level of protection from earthquakes than limited or normal occupancy structures or other non-critical structures. As a minimum, all structures which could have an effect on the loss of life should be designed to remain standing in the event of a major earthquake even if rendered useless. Critical facilities on the other hand, should not only remain standing, but should be able to operate at peak efficiency in the event of a disaster. The taxonomy of Critical Facilities presented is intended for use as a guide in evaluating the importance of each facility relative to overall public safety, in terms of fire, inundation, and seismic hazards.

Based on the discussion above and on input from representatives from the City of Hemet, the following seismic events are recommended as the basis for establishing earthquake design standards:

TAXONOMY OF CRITICAL FACILITIES

Land Use/Facility	Safety Characteristic			Classification	
	Potential Effect on Loss of Life	Emergency Response	Vital Function	Critical	Normal
<u>Developed Land</u>					
RESIDENTIAL					
- Single Family					X
- Multi-family and Mobile homes					X
- Apartments					X
COMMERCIAL					
- Neighborhood Centers (e.g., grocery, barber, drug store)					X
- Community Centers (e.g., private offices, banks, restau- rants, comparison shopping)					X
- Highway Centers (e.g., motels, fast food, restau- rants)					X
- Heavy Commercial/ Light Industry (e.g., contractors yards, distribution ware- houses, manufactur- ing and assembly plants)					X
- Heavy Industry					X
PUBLIC AND SEMI- PUBLIC USES					
- Hospitals		X	X	X	
- Schools/Colleges	X			X	
- Parks and Recrea- tion Areas					X
- Government Facili- ties (e.g., civil defense quarters, fire and police stations, govern- ment offices)		X	X	X	
- Utilities (e.g., power plants (nu- clear fossil fuel) gas and electric lines and stations, large dams, radio/ TV/microwave centers and lines, aqueducts, pipelines, sewage treatment facilities, gas stations, water- works)		X	X	X	
- Roads and Highways		X	X	X	
- Railroads			X	X	
- Airports			X	X	
- Assembly Halls (e.g., theaters, auditoriums) X					X
- Refuse Disposal Sites					X
- Cemeteries					X
<u>Undeveloped Land</u>					
- Agriculture					X

<u>Land Use Group</u>	<u>Facility Type</u>	<u>Facility</u>	<u>Appropriate Recurrence Interval (Years)</u>	<u>Magnitude by fault</u> <u>San Jacinto</u>
A	Emergency Services	Hospitals, Fire Stations, Police Stations, CO HQ, Lifeline - Gas Electric, Water, Ambulance Services, Emergency Broadcast Systems, Lifeline Telephone Systems, Power Plants (Nuclear, Fossil Fuel), Dams, Reservoirs.	Maximum Credible	7.5
B	Critical Facilities	Schools, Theaters, Auditoriums, Utility Substations, Sewage Treatment Plants, Waterworks, Local Gas and Electric Lines, Major Highways, Bridges, Tunnels, Aqueducts, Pipelines, Public Service Facilities, Public Assembly w/ Capacity of 100 or more.	200-500	7.0
C	<u>Normal Facilities</u> Category 1	Heavy Industrial, Office Buildings, Commercial Centers, Hotels and Motels, Parks and Financial Establishments, High Density Residential, Public Service Stations, Health Care Clinics.	100-200	6.5
D	Category 2	Light Industrial, Low Density, Residential, Warehousing and Storage, Agricultural, Parks, Convenience Centers.	30-100	6.0

With respect to flood hazards, the magnitude event recommended as the basis for natural flood control and floodplain planning and management is the 100-year flood. The 100-year flood is almost universally accepted by federal and state agencies involved with flood control as the basis for describing flood hazards and establishing flood insurance and other programs. Sufficient data is not available at this time to recommend specific flood parameters for planning purposes relative to dam inundation except for evacuation purposes.

III. HAZARD REDUCTION

A. ORGANIZATION AND PURPOSE OF RECOMMENDATIONS

The previous section of this document represents a synthesis of the existing natural hazards within the study area, and supplements the criteria documented in the Technical Section of the report. The intent of that section is to summarize the general framework within which planning for seismic safety and public safety should take place. In this section, recommendations are presented which encompass the general planning goals and policies for hazard reduction in the City of Hemet. This section also outlines specific recommended planning actions to implement the Element's goals and policies.

B. GOAL RECOMMENDATIONS

To plan effectively for reducing hazards to acceptable levels of risk it is necessary that goals be set and adhered to. Goals address general policy directions which form the basis for planning decisions and actions. The recommended goals for hazards reduction in the City of Hemet.

1. To minimize injury and the loss of life from hazardous natural events.
2. To minimize damage to public and private property resulting from hazardous natural events.
3. To minimize social and economic dislocations resulting from injury, loss of life, and property damage caused by hazardous natural events.

C. POLICY RECOMMENDATIONS

The following recommended policies complement the planning goals and define specific directions for the City to take in reducing natural hazards.

- 1.0 Adopt new ordinances and amend existing ordinances which require the incorporation of seismic safety and safety considerations in developments under the City's jurisdiction.
- 2.0 Provide for the identification and evaluation of existing structural hazards.
- 3.0 Risks associated with hazardous structures should be reduced to acceptable levels through orderly hazard reduction programs.

- 4.0 Provide for more detailed scientific analyses of natural hazards in the study area.
- 5.0 Regulate land use in areas of significant natural hazard.
- 6.0 Provide for the education of the community regarding the nature and extent of natural hazards in the study area.
- 7.0 Provide for the maintenance and upgrading of disaster response plans.
- 8.0 Provide for review and upgrading of the Seismic Safety and Safety Elements.

D. IMPLEMENTATION RECOMMENDATIONS

The implementation recommendations in this section are intended to provide the City with a series of specific planning actions to achieve the goals of these Elements and carry out the policies recommended above. While it would be advisable to fully implement each of the recommended actions, it is recognized that unlimited resources to that end are not available. These recommended actions should be thought of, then, as options to be implemented as resources provide. To aid in determining priorities for the allocation of resources in the community, the recommended policies and actions are listed below in their general order of importance to achieving the goals of these Elements.

1.0 Adopt new ordinances and amend existing ordinances which require the incorporation of seismic safety and safety consideration in developments under the City's jurisdiction

- 1.1 Adopt the 1976 Uniform Building Code.
- 1.2 Using the geological data provided in the Seismic Safety Element, amend Chapter 23, Section 2314, (Earthquake Regulations) of the Uniform Building Code to account for the expected maximum ground accelerations of the recommended design earthquakes. Amending Section 2314 involves revising the basic lateral force equation in the section, and requires analysis by a qualified structural engineer. The intent of the revisions is to reflect

the levels of acceptable risk adopted in this Element. (See p. 37)²

- 1.3 Amend Chapter 70, Section 7006, of the Uniform Building Code to require soils engineering and geological engineering investigations in areas of moderate and high landslide risk and in potential liquefaction and subsidence areas. To insure adequate review and use of the investigation reports, the City should retain a qualified engineering geologist on a full or part-time basis to review the reports and assist the Building and Safety Department in designing public projects.

2.0 Provide for the identification and evaluation of existing structural hazards.

- 2.1 It is recommended that structures within the study area of this report be inspected for conformance with the amended Uniform Building Code earthquake regulations. Inspections should be conducted according to the following priorities:

- (a) emergency service facilities (e.g. fire and police stations, hospitals)
- (b) other critical facilities (e.g. schools, utility lines, government buildings)
- (c) high occupancy non-critical facilities (e.g. dormitories, apartments)
- (d) normal or limited occupancy non-critical facilities (offices, low density residential buildings)

Within each priority group, it is recommended that facilities built before 1933 be inspected first, then those built between 1933 and 1948, and lastly, those constructed after 1948. The significance of the year 1933 is that the Field and Riley Acts became law in California that year and required reinforcement in schools and certain other structures (Appendix B). Structures built before 1933, especially larger commercial structures, are more likely to be

²At this time, proposed revisions to Section 2314 are being considered by the International Conference of Building Officials for adoption in the 1976 UBC. The proposed revisions would significantly increase the minimum lateral force requirements, and could, if adopted, reduce the extent of revision necessary to amend the Code in conformance with expected seismic events.

unreinforced masonry block buildings which are most susceptible to collapse in earthquakes. In 1948, earthquake regulations were adopted as a legally binding section of the UBC for the first time. Previously, earthquake standards were set forth in the Appendix of the UBC and were not a mandated part of the Code. It is more likely, then, that a building constructed before 1948 would be less able to withstand the shock of an earthquake than one built after 1948. It is also recommended that public structures be inspected before private structures.

Table 3 (abridged from Pacific Fire Rating Bureau) may also be used as a general indicator in older construction for use in establishing a priority ranking system for evaluating structures. Buildings with a high susceptibility to damage rating (five or over) should be selected for structural inspection before those with low ratings. A high priority should be placed on establishing a definition of facilities that handle explosive, flammable, or toxic materials and on an evaluation of their seismic vulnerability.

- 2.2 Caltrans should review its facilities and roadways within the study area to determine the potential impact of expected earthquakes, and should forward comments to the City. The Circulation Element of the General Plan and potential evacuation routes should be revised, if necessary.
- 2.3 The Atchison, Topeka & Santa Fe Railway Company should review its lines and yards within the study area to determine the potential impact of the expected earthquakes, and should forward comments to the City. The Circulation Element of the General Plan should be revised, if necessary.
- 2.4 The owners of any existing dams adjacent to the City should inspect their dams using the seismic response spectra as guidelines to determine these structure's ability to withstand expected earthquakes, and should forward comments to the City.
- 2.5 The Southern California Gas Company and the Edison Company should review their facilities and distribution/transformation networks and centers to determine the potential impact of expected earthquakes, and should forward comments to the

TABLE 4.
HAZARD COMPARISON OF NON-EARTHQUAKE-RESISTIVE BUILDINGS

Simplified Description of Structural Type	Relative Damagability (in order of increasing susceptibility to damage)
Small wood-frame structures, i.e. dwellings not over 3,000 sq. ft. and not over 3 stories	1
Single or multistory steel-frame buildings with concrete exterior walls, concrete floors, and concrete roof. Moderate wall openings	1.5
Single or multistory reinforced-concrete buildings with concrete exterior walls, concrete walls, and concrete roof. Moderate wall openings	2
Large area wood-frame buildings and other wood frame buildings	3 to 4
Single or multistory steel-frame buildings with unreinforced masonry exterior wall panels; concrete floors and concrete roof	4
Single or multistory reinforced-concrete frame buildings with unreinforced masonry exterior wall panels, concrete floors and concrete roof	5
Reinforced concrete bearing walls with supported floors and roof of any material (usually wood)	5
Buildings with unreinforced brick masonry having sand-line mortar; and with supported floors and roof of any material (usually wood)	7 up
Bearing walls of unreinforced adobe, unreinforced hollow concrete block, or unreinforced hollow clay tile	Collapse hazard in moderate shocks

This table is intended for buildings not containing earthquake bracing, and in general, is applicable to most older construction. Unfavorable foundation conditions and/or dangerous roof tanks can increase the earthquake hazard greatly.

City. These utilities should also review their gas and power lines for potential fire hazards in the event of an earthquake.

3.0 Risks associated with hazardous structures should be reduced to acceptable levels through orderly hazard reduction programs

- 3.1 Structures identified as not conforming to amended earthquake standards or as hazardous in terms of fire or flooding should be brought into conformance with acceptable levels of risk by programs including, but not limited to, structural rehabilitation, occupancy reduction, and demolition and reconstruction.
- 3.2 A review committee should be established by the City Council to consider the desirability of initiating condemnation proceedings against structures found to be unsafe.
- 3.3 The City should advocate the expansion of State and Federal relocation assistance funds and programs to aid persons and businesses displaced from hazardous buildings.

4.0 Provide for more detailed scientific analyses of natural hazards in the study area

- 4.1 Provide for a detailed field study of the San Jacinto Fault Hazard Management Zone, including sub-surface trenching, to provide a more refined evaluation of the surface rupture potential of the fault.
- 4.2 Such studies as called for in 4.1 above, may be undertaken by local government or private enterprise. In either case, the staff geologist of the County Planning Department should be notified in advance of subsurface work to secure his evaluation of fault activity and location during the trenching phase when feasible.
- 4.3 Require site-by-site soils and geologic engineering studies for proposed development projects in areas of moderate to high landslide risk to assess natural and graded slope stability. Slope stability calculations should incorporate the ground shaking parameters presented in the Technical Report.

- 4.4 Require site-by-site soils and geologic engineering studies in areas of potential settlement and evaluate these potential hazards using the ground shaking parameters presented in the Technical Report.
- 4.5 Institute a building strong-motion instrumentation program for buildings over four (4) stories in height, if such buildings are anticipated.
- 4.6 Encourage completion of flood control studies and projects that would serve to mitigate flood hazards that may effect the City.
- 5.0 Regulate land use in areas of significant natural hazard
 - 5.1 No development should be permitted in San Jacinto Fault Hazard Management Zone until a detailed geological evaluation of the surface rupture potential of the fault is completed and adequate building set-backs from the fault are established.
 - 5.2 The Riverside County Planning Staff geologist should be required to evaluate all building set-back recommendations and establish geologic guidelines for construction adjacent to active faults.
 - 5.3 No development should be permitted in any seismic zone unless it conforms to the recommended revised Uniform Building Code Earthquake Regulations.
 - 5.4 No development should be permitted in areas of high or moderate landslide risk without a required slope stability investigation at the site level.
 - 5.5 No emergency facilities should be permitted to locate within the 100-year flood plain. Critical facilities should be permitted in the 100-year flood plain only if adequate flood control measures are provided.
 - 5.6 No emergency or critical facility should be permitted to locate in high or medium fire hazard areas without an investigation of the development's vulnerability to fire and its potential as a source of ignition.
 - 5.7 The use of untreated shake roofs in areas of high fire hazard should be prohibited.

6.0 Provide for the education of the community regarding the nature and extent of natural hazards in the study area

6.1 Develop an information release program to familiarize the citizens of region with the Seismic Safety and Safety Elements. Special attention should be afforded to those groups particularly susceptible to seismic, fire, and flooding hazards including, but not limited to, school districts, agencies involved with the aged, and agencies involved with handicapped persons. These agencies should be encouraged to develop educational programs of their own relative to hazard awareness. The conclusions and recommendations of these elements should also be provided to land developers and those involved in the real estate profession. Appendix A provided a list of earthquake safety procedures.

6.2 Establish community programs that train volunteers to assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood.

6.3 Initiate education programs in lower grades using displays and demonstrations that would expose younger children to the nature and strength of fire. Such programs would tend to replace their natural curiosity with a sense of respect.

6.4 Support or sponsor exhibits and presentations in secondary schools which demonstrate the more involved aspects of fire dynamics, i.e., major contributing factors to fire hazard and the relationship of fire to the natural ecology. Encourage parental cooperation and assistance in overall fire education programs.

7.0 Provide for the maintenance and upgrading of disaster response plans

7.1 Maintain a disaster response program for the City of Hemet. Objectives of the program should be:

- (a) To save lives and protect property
- (b) To provide a basis for direction and control of emergency operations
- (c) To provide for the continuity of government
- (d) To repair and restore essential systems and services (e.g. emergency water supplies
- (e) To provide for the protection, use, and distribution of remaining resources

- (f) To coordinate operations with the civil defense emergency operations or other jurisdictions.
- (g) To provide for a maximum degree of self-sufficiency by the City in the event of a major disaster.

Since a large earthquake will severely affect many cities and hundreds of thousands of people, the efforts of the Federal and State emergency services will be severely over-extended. It is advisable that the City of Hemet be prepared to serve itself and maintain continued functioning of necessary services rather than expect adequate aid from outside organizations.

- 7.2 Conduct periodic earthquake, and flooding emergency drills. These drills should be coordinated on a regional basis in cooperation with all involved jurisdictions.

8.0 Provide for review and upgrading of the Seismic Safety and Safety Elements

- 8.1 Upon adoption of the Seismic Safety and Safety Elements, the City Administrative Staff should oversee the implementation of the Elements and advise the Council of implementation progress.
- 8.2 The Seismic Safety and Safety Elements should be reviewed by the City of Hemet Department of Community Development annually, and should be comprehensively revised every five years, or whenever substantially new scientific evidence becomes available.

IV. RELATIONSHIPS TO OTHER GENERAL PLAN ELEMENTS

The Seismic Safety and Safety Elements are the major natural hazards analyzed in the General Plan and, as such, have important policy implications for other elements in the Plan. In particular, the Seismic Safety and Safety Elements provide significant information for the Land Use, Housing, Open Space, and Circulation Elements. It is recommended that these Elements be prepared or revised to give specific recognition to the policies adopted in the Seismic Safety and Safety Elements.

The Land Use Element will be influenced most directly by the recommendations of Policy 5.0 to regulate land use in areas of significant natural hazards. The Land Use Element may also recommend land use controls for those areas in which "stacking" or combinations of individual hazard zones result in a high level of overall hazard. Figure 8 shows the effects of "stacking" on various land uses.

The policies of these Elements provide input to the Housing Element primarily by recommending design and construction modifications. The following recommendations pertain directly to the Housing Element:

1. All new construction should conform to the revised Uniform Building Code Earthquake Regulations.
2. Existing high occupancy residential structures found to be seismically vulnerable should be strengthened or replaced or their occupancy level should be reduced.
3. Construction on the 100-year flood plain should provide adequate flood-proofing, if other flood control measures are not implemented.
4. Untreated shingle roofs should be prohibited in areas of high fire hazard.

The Seismic Safety and Safety Element identify certain areas which should be considered for open space designation a part of the Open Space Element. These areas include lands designated as high landslide risk areas, areas of high liquefaction potential, the 100-year flood plain, and areas subject to inundation immediately beneath major dams.

BUILDING TYPE/LAND USE		SEISMIC, SECONDARY SEISMIC, AND FLOOD HAZARDS ZONES (SHOWN ON PLATES I AND II.)																																		
		1/HMZ	2/IA	IB	IC	ID	IE	IIA	IIB	IIC	IID	IIE	IIIA	IIIB	IIIC	IIID	IIIE	IVA	IVB	IVC	IVD	IVE	VA	VB	VC	VD	VE	3/H+	H-	M	L	N	4/LL	L	5/100F	
EMERGENCY FACILITIES	Hospitals, Fire Stations, Police Stations, Civil Defense Headquarters, Lifeline Systems for Gas, Electric, Water, Telephone, Emergency Broadcast Systems, Ambulance Services, Power Plants (Nuclear, Fossil Fuel), Dams, Reservoirs.	⊗											⊙	⊙				⊙	⊗					⊗	⊗	⊙				⊙	○	○	●			⊗
CRITICAL FACILITIES	Schools, Theaters, Auditoriums, Utility Substations, Sewage Treatment Plants, Waterworks, Local Gas and Electric Lines, Major Highways, Bridges, Tunnels, Aqueducts, Pipe Lines, Public Service Facilities, Public Assembly-Capacity of 100 or more.	⊗											⊙	⊙				⊙	⊗					⊗	⊗	⊙				⊙	○	●	●			⊙
NORMAL FACILITIES	Category 1 Heavy Industrial, Office Buildings, Commercial Centers, Hotels and Motels, Banks and Financial Establishments, High Density Residential, Service Stations, Healthcare Clinics.	⊙											○	⊙				⊙	⊙					⊙	⊙	○				○	○	●	●			○
	Category 2 Light Industrial, Low Density Residential, Warehousing and Storage, Agriculture, Parks.	○											●	○				○	○					○	○	●				○	○	●	●			○

Explanation

● Generally Suitable ○ Provisionally Suitable ⊙ Generally Unsuitable ⊗ Restricted

Notes: This Chart is for General Land Use Planning only. Suitability for specific uses on a particular site must be confirmed by further investigation. An area evaluated as generally unsuitable for a particular use does not necessarily preclude the use if no other suitable alternative sites are available, provided that all potential hazards can be mitigated. In the case of restricted areas, mitigation is extremely difficult and in some instances, impossible.

1/ Hazard Management Zone 2/ Ground shaking zones 3/ Landslide risk zones 4/ Liquefaction potential zones 5/ 100-year flood zone

Figure 12. Land Use/Risk Matrix.

The Circulation Element should recognize that the transportation network in Hemet will be hard hit in the event of a mjaor earthquake or flood. An earthquake will affect primarily freeway overpasses, road bridges, and railroad grade crossings. The effects expected will be similar to what occurred in the Sylmar-San Fernando Valley area of Southern California in the 1971 earthquake. The response spectra presented in the Technical Section of the Seismic Safety Element should be used by structural engineers in the evaluation of existing freeway overpasses and other important grade separations. New construction of bridges, overpasses, and other grade crossings should also utilize seismic response design criteria.

In the event of a 100-year flood or dam failure of Little Lake, Highway 74 which traverses the City, can expect to be inundated. This is expected to have an important impact on potential evacuation of the area, and alternate evacuation measures should be planned.

APPENDIX A

Earthquake Safety Procedures

1. Personal earthquake preparedness is the first step in disaster preparedness. This includes having a family disaster plan, knowing evacuation routes, and having a kit of supplies. It is important to know what to do in case of an earthquake, and to practice these procedures regularly.

2. The first step in disaster preparedness is to know what to do in case of an earthquake. This includes having a family disaster plan, knowing evacuation routes, and having a kit of supplies. It is important to know what to do in case of an earthquake, and to practice these procedures regularly.

3. The second step in disaster preparedness is to know where to go in case of an earthquake. This includes knowing evacuation routes, and having a kit of supplies. It is important to know where to go in case of an earthquake, and to practice these procedures regularly.

APPENDIX A

Earthquake Safety Procedures

4. The third step in disaster preparedness is to know how to protect yourself in case of an earthquake. This includes knowing how to protect yourself in case of an earthquake, and practicing these procedures regularly.

5. It is important to know how to protect yourself in case of an earthquake. This includes knowing how to protect yourself in case of an earthquake, and practicing these procedures regularly.

Earthquake Safety Procedures

6. The fourth step in disaster preparedness is to know how to protect yourself in case of an earthquake. This includes knowing how to protect yourself in case of an earthquake, and practicing these procedures regularly.

7. If you are inside a building, it is important to know how to protect yourself in case of an earthquake. This includes knowing how to protect yourself in case of an earthquake, and practicing these procedures regularly.

EARTHQUAKE SAFETY PROCEDURES

Before an Earthquake

1. Potential earthquake hazards in the home should be removed or corrected. Top-heavy objects and furniture, such as bookcases and storage cabinets, should be fastened to the wall and the largest and heaviest objects placed on lower shelves. Water heaters and other appliances should be firmly bolted down, and flexible connections should be used whenever possible.

2. Supplies of food and water, flashlight, a first-aid kit, and a battery-powered radio should be set aside for use in emergencies. Of course, this is advisable for other types of emergencies, as well as for earthquakes.

3. One or more members of the family should have a knowledge of first aid procedures because medical facilities nearly always are overloaded during an emergency or disaster, or may themselves be damaged beyond use.

4. All responsible family members should know what to do to avoid injury and panic. They should know how to turn off the electricity, water, and gas; they should know the locations of the main switch and valves. This is particularly important for teenagers who are likely to be alone with smaller children.

5. It is most important for a resident of California to be aware that this is "earthquake country" and that earthquakes are most likely to occur again where they have occurred before. Building codes that require earthquake-resistant construction should be vigorously supported and, when enacted into law, should be rigorously enforced. If effective building codes and grading ordinances do not exist in your community, support their enactment.

During An Earthquake

1. The most important thing to do during an earthquake is to remain calm. If you can do so, you are less likely to be injured. If you are calm, those around you will have a greater tendency to stay calm, too. Make no moves or take no action without thinking about the possible consequences. Motion during an earthquake is not constant; commonly, there are a few seconds between tremors.

2. If you are inside a building, stand in a strong doorway or get under a desk, table, or bed. Watch for falling plaster, bricks, light fixtures, and other objects. Stay away from tall furniture, such as china cabinets, bookcases, and shelves. Stay away from windows, mirrors, and chimneys. In tall buildings, it is best to get under a desk if it is securely fastened to the floor, and to stay away from windows or glass partitions.

3. Do not rush outside. Stairways and exits may be broken or may become jammed with people. Power for elevators and escalators may have failed. Many of the 115 persons who perished in Long Beach and Compton in 1933 ran outside only to be killed by falling debris and collapsing chimneys. If you are in a crowded place such as a theater, athletic stadium, or store, do not rush for an exit because many others will do the same thing. If you must leave a building, choose your exit with care and, when going out, take care to avoid falling debris and collapsing walls or chimneys.

4. If you are outside when an earthquake strikes, try to stay away from high buildings, walls, power poles, lamp posts, or other structures that may fall. Falling or fallen electrical power lines must be avoided. If possible, go to an open area away from all hazards but do not run through the streets. If you are in an automobile, stop in the safest possible place, which, of course, would be an open area, and remain in the car.

After An Earthquake

1. After an earthquake, the most important thing to do is to check for injuries in your family and in the neighborhood. Seriously injured persons should not be moved unless they are in immediate danger of further injury. First aid should be administered, but only by someone who is qualified.

2. Check for fires and fire hazards. If damage has been severe, water lines to hydrants, telephone lines, and fire alarm systems may have been broken; contacting the fire department may be difficult. Some cities, such as San Francisco, have auxiliary water systems and large cisterns in addition to the regular system that supplies water to fire hydrants. Swimming pools, creeks, lakes, and fish ponds are possible emergency sources of water for fire fighting.

3. Utility lines to your house - gas, water, and electricity - and appliances should be checked for damage. If there are gas leaks, shut off the main valve which is usually at the gas meter. Do not use matches, lighters, or open-flame appliances until you are sure there are no gas leaks. Do not use electrical switches or appliances if there are gas leaks, because they give off sparks which could ignite the gas. Shut off the electrical power if there is damage to the wiring; the main switch usually is in or next to the main fuse or circuit breaker box. Spilled flammable fluids, medicines, drugs, and other harmful substances should be cleaned up as soon as possible.

4. Water lines may be damaged to such an extent that the water may be off. Emergency drinking water can be obtained from water heaters, toilet tanks, canned fruits and vegetables, and melted ice cubes. Toilets should not be flushed until both the incoming water lines and outgoing sewerlines have been

checked to see if they are open. If electrical power is off for any length of time, plan to use the foods in your refrigerator and freezer first before they are spoiled. Canned and dried foods should be saved until last.

5. There may be much shattered glass and other debris in the area, so it is advisable to wear shoes or boots and a hard hat if you own one. Broken glass may get into foods and drinks. Liquids can be either strained through a clean cloth such as a handkerchief or decanter. Fireplaces, portable stoves, or barbecues can be used for emergency cooking but the fireplace chimney should be carefully checked for cracks and other damages before being used. In checking the chimney for damage, it should be approached cautiously, because weakened chimneys may collapse with the slightest of aftershocks. Particular checks should be made of the roof line and in the attic because unnoticed damage can lead to a fire. Closets and other storage areas should be checked for objects that have been dislodged or have fallen, but the doors should be opened carefully because of objects that may have fallen against them.

6. Do not use the telephone unless there is a genuine emergency. Emergencies, and damage reports, alerts, and other information can be obtained by turning on your radio. Do not go sightseeing; keep the streets open for the passage of emergency vehicles and equipment. Do not speculate or repeat the speculations of other - this is how rumors start.

7. Stay away from beaches and other waterfront areas where seismic sea waves (tsunamis), sometimes called "tidal waves", could strike. Again, your radio is the best source of information concerning the likelihood that a seismic sea wave will occur. Also stay away from steep landslide-prone areas if possible, because aftershocks may trigger a landslide or avalanche, especially if there has been a lot of rain and the ground is nearly saturated. Also stay away from earthquake-damaged structures. Additional earthquake shocks known as "aftershocks" normally occur after the main shock, sometimes over a period of several months. These are usually smaller than the main shock but they can cause damage, too, particularly to damaged and already weakened structures.

8. Parents should stay with young children who may suffer psychological trauma if parents are absent during the occurrence of aftershocks.

9. Cooperate with all public safety and relief organizations. Do not go into damaged areas unless authorized; you are subject to arrest if you get in the way of, or otherwise hinder, rescue operations. Martial law has been declared in a number of earthquake disasters. In the 1906 disaster in San Francisco, several looters were shot.

10. Send information about the earthquake to the Seismological Field Survey to help earth scientists understand earthquakes better.

Summary of Significant Court Decisions
and Legislation

(Source: Draft of the Report of the National Academy of Sciences, 1978)

In recent years there have been many attempts to improve the quality of the environment. The following are some of the most significant.

APPENDIX B

SUMMARY OF SIGNIFICANT
COURT DECISIONS AND LEGISLATION

1. *Shelton v. Federal Bureau of Investigation*, 443 U.S. 640 (1979).
The Supreme Court held that a statute which authorized the FBI to conduct surveillance of persons suspected of being members of the Communist Party was unconstitutional. The Court held that the statute was too broad and that it violated the First Amendment.
2. *Los Angeles v. Alvarado*, 440 U.S. 680 (1979).
The Supreme Court held that a police officer's use of force to arrest a suspect was reasonable. The Court held that the officer's use of force was justified because the suspect was armed and dangerous.
3. *City of Los Angeles v. Heller*, 448 U.S. 594 (1980).
The Supreme Court held that a city's ordinance which prohibited the use of private property for commercial purposes was unconstitutional. The Court held that the ordinance was too broad and that it violated the First Amendment.
4. *Agostini v. Felton*, 521 U.S. 203 (1997).
The Supreme Court held that a state's provision of in-state tuition for private schools was constitutional. The Court held that the provision was not a violation of the Establishment Clause because it was a neutral benefit that was available to all students.
5. *Agostini v. Felton*, 521 U.S. 203 (1997).
The Supreme Court held that a state's provision of in-state tuition for private schools was constitutional. The Court held that the provision was not a violation of the Establishment Clause because it was a neutral benefit that was available to all students.

Summary of Significant Court Decisions and Legislation

(Source: Urban Geology Master Plan for California, 1973)

In recent years there have been many attempts by government to reduce losses from geologic hazards. The following summaries are some of the more important ones.

COURT DECISIONS

1. Sheffett decision (Los Angeles Superior Court Case No. 32487): Declared that a public entity is liable for damages to adjacent property resulting from improvements planned, specified or authorized by the public entity in the exercise of its governmental power. (The State Supreme Court refused to rehear this decision, which establishes a judicial precedent.)
2. L.A. County Superior Court (Case No. 684595 and consolidated cases): This decision found the County liable for damages which may have resulted from roadwork and the placement of fill by the County. This case was in regard to the Portuguese Bend landslide, Palos Verdes Hills, Los Angeles County, California.
3. City of Bakersfield vs Miller (48 Cal. Rptr. 889), heard in the State Supreme Court 1966: This decision affirms that the city may declare an older structure not in compliance with the newly adopted Uniform Building Code to be a public nuisance. Further, the city may enforce abatement of the non-conforming condition even though to do so may require the building to be demolished.
4. Burgess vs. Conejo Valley Development Co. (Connor vs. Great Western Savings and Loan Association) (73 Cal. Rptr. 369) heard in the State Supreme Court in 1968, concerning damage to tract homes from expansive soil in Thousand Oaks, Ventura County: This decision affirmed that the home buyer, both first buyer and all subsequent ones, has the right to protection from negligent construction practice leading to damage. In this case, neither contractor, county inspectors, nor representatives of the major lending institution acted to ascertain expansive soil conditions, or to prevent damage from them.
5. Oakes vs. The McCarthy Co. (California Appellate Reports, 2d Series, 267, 1968) the court held that in the Palos Verdes area, Los Angeles County, a developer and soils engineering company could be liable in negligence for damages to a home resulting from using improper (clay) fill material and improperly compacting that fill so that earth movement resulted. Also, the court awarded punitive damages against the developer for fraudulent conceal-

ment of material facts concerning the property, i.e., failure to volunteer to the prospective buyer that the house was built upon fill.

LEGISLATION

PUBLIC RESOURCES CODE

Section 660-662 and 2621-2625: These sections require the State Geologist to delineate special studies zones encompassing potentially and recently active fault traces. It requires cities and counties to exercise specified approval authority with respect to real estate developments or structures for human occupancy within such delineated zones.

Section 2700-2708: These sections require the Division of Mines and Geology to purchase and install strong-motion instruments (to measure the effects of future earthquakes) in representative structure and geologic environments throughout the state.

Section 2750: Establishes a state mining and minerals policy which, among other things, encourages wise use of mineral resources.

EDUCATION CODE

Section 15002.1: This section requires that geological and soils engineering studies be conducted on all new school sites and on existing sites where deemed necessary by the Department of General Services.

Section 15451-15466: These sections constitute the Field Act and require that public schools be designed for the protection of life and property. These sections, enacted in 1933 after the Long Beach earthquake, are enforced by the State Office of Architecture and Construction in accordance with regulations contained in Title 21 of the California Administrative Code.

HEALTH AND SAFETY CODE

Sections 15000 et seq.: These sections require that geological and engineering studies be conducted on each new hospital or additions affecting the structure on an existing hospital, excepting therefrom one story Type V buildings 4000 sq. ft. or less in area.

Sections 19100-19150: These sections constitute the Riley Act and require certain buildings to be constructed to resist lateral forces, specified in Title 24 California Administrative Code.

Section 17922, 17951-17958.7: These sections require cities and counties to adopt and enforce the Uniform Building Code, including a grading section (chap. 70), a minimum protection against some geologic hazards.

BUSINESS AND PROFESSIONAL CODE

Section 7800-7887: These sections provide for the registration of geologists and geophysicists, and the certification of certain geologists in the specialty of engineering geology.

Section 11010: This section requires that a statement of the soil conditions be prepared and needed modifications be carried out in accordance with the recommendations of a registered civil engineer.

Section 11100-11629: These sections require studies in subdivisions to evaluate the possibilities of flooding and unfavorable soils.

GOVERNMENT CODE

Section 8589.5: This section requires that inundation maps and emergency evacuation plans be completed for areas subject to inundation by dam failure.

Section 65300-65302.1: These sections require that each city and county shall adopt the following elements:

Seismic Safety Element consisting of the identification and appraisal of seismic hazards including an appraisal of landsliding due to seismic events.

Conservation element including the conservation, development and utilization of minerals.

Safety element including protection of the community from geologic hazards including mapping of known geologic hazards.

4. GENERAL CHARACTERISTICS OF EARTHQUAKES

1. The Focus of Earthquakes

Earthquakes are generally defined as sudden and violent movements of the earth's surface. They are caused by the release of energy stored in the earth's crust. The energy is released in the form of seismic waves that travel through the earth's interior. The point where the energy is released is called the focus of the earthquake. The focus is usually located at a depth of between 10 and 700 kilometers below the earth's surface. The depth of the focus is an important factor in determining the magnitude of the earthquake. The deeper the focus, the less damage is likely to be done to the surface.

There are three types of earthquakes: (1) tectonic earthquakes, (2) volcanic earthquakes, and (3) explosion earthquakes. Tectonic earthquakes are caused by the movement of the earth's crust. They are the most common type of earthquake and are responsible for most of the damage and loss of life. Volcanic earthquakes are caused by the movement of magma within the earth's crust. They are usually localized and do not cause as much damage as tectonic earthquakes. Explosion earthquakes are caused by the explosion of nuclear weapons or other explosives. They are also localized and do not cause as much damage as tectonic earthquakes.

APPENDIX C

GENERAL CHARACTERISTICS OF EARTHQUAKES

The following are the general characteristics of earthquakes: (1) They are sudden and violent movements of the earth's surface. (2) They are caused by the release of energy stored in the earth's crust. (3) The energy is released in the form of seismic waves that travel through the earth's interior. (4) The point where the energy is released is called the focus of the earthquake. (5) The focus is usually located at a depth of between 10 and 700 kilometers below the earth's surface. (6) The depth of the focus is an important factor in determining the magnitude of the earthquake. (7) The deeper the focus, the less damage is likely to be done to the surface. (8) There are three types of earthquakes: tectonic, volcanic, and explosion earthquakes. (9) Tectonic earthquakes are the most common type and are responsible for most of the damage and loss of life. (10) Volcanic earthquakes are usually localized and do not cause as much damage as tectonic earthquakes. (11) Explosion earthquakes are also localized and do not cause as much damage as tectonic earthquakes.

(1) An earthquake is a sudden and violent movement of the earth's surface. It is caused by the release of energy stored in the earth's crust. The energy is released in the form of seismic waves that travel through the earth's interior. The point where the energy is released is called the focus of the earthquake. The focus is usually located at a depth of between 10 and 700 kilometers below the earth's surface. The depth of the focus is an important factor in determining the magnitude of the earthquake. The deeper the focus, the less damage is likely to be done to the surface.

(2) There are three types of earthquakes: tectonic, volcanic, and explosion earthquakes. Tectonic earthquakes are the most common type and are responsible for most of the damage and loss of life. They are caused by the movement of the earth's crust. Volcanic earthquakes are caused by the movement of magma within the earth's crust. They are usually localized and do not cause as much damage as tectonic earthquakes. Explosion earthquakes are caused by the explosion of nuclear weapons or other explosives. They are also localized and do not cause as much damage as tectonic earthquakes.

(3) The energy released in an earthquake travels through the earth's interior in the form of seismic waves. There are two main types of seismic waves: body waves and surface waves. Body waves travel through the earth's interior and are the most powerful type of seismic wave. They are responsible for most of the damage and loss of life. Surface waves travel along the earth's surface and are the most common type of seismic wave. They are responsible for most of the damage and loss of life. The magnitude of an earthquake is a measure of the amount of energy released. It is determined by the amplitude of the seismic waves. The larger the amplitude, the greater the magnitude. The magnitude of an earthquake is an important factor in determining the amount of damage and loss of life.

A. GENERAL CHARACTERISTICS OF EARTHQUAKES

1. The Source of Earthquakes

Earth scientists are generally agreed that earthquakes originate as the result of an abrupt break or movement of the rock in the relatively brittle crust of the earth. The earthquake is the effect of the shock waves generated by the break, much the same as sound waves (a noise) are generated by breaking a brittle stick. If the area of the break is small and limited to the deeper part of the crust, the resulting earthquake will be small. However, if the break is large and extends to the surface, then the break can result in a major earthquake.

These breaks in the earth's crust are called faults. In California, faults are extremely common, and vary from the small breaks of an inch or less that can be seen in almost any road-cut, to the larger faults such as the San Andreas on which movement over many millions of years has amounted to hundreds of miles. In addition to the size of faults, their "age" is also important. Many large faults have not moved for millions of years; they are considered "dead" or "inactive." They were probably the source of great earthquakes millions of years ago but are not considered dangerous today.

Since faults vary as to the likelihood of their being the source of an earthquake, considerable effort has, and is continuing to be expended by geologists and seismologists to determine and delineate the faults likely to generate significant earthquakes. These faults are classified generally as follows:

- (1) An historically active fault is one which is known to have slipped during historical time, or one which is associated with an alignment of earthquake epicenters. In California this "historical time" span is limited to approximately 150 years.
- (2) An active fault is one that has moved in the recent geologic past, and that can be expected to move again in the foreseeable future. The "recent geologic past" is generally interpreted to include recent geologic time; a period of approximately 10,000 years. However, a precise definition of "active fault," such as is needed where the term is included in legal documents, is still a matter of considerable debate.
- (3) A potentially active fault is one that lacks the criteria to be classified as active, but which must be considered suspect because of offset of Quaternary sediments (up to approximately 2 million years old) or the presence of scattered earthquake epicenters. This classification, may be applied as much due to lack of definitive data as to the presence of data that definitely precludes recent movement.

2. Describing an Earthquake

Several terms are used to describe the location, "size," and effects of an earthquake. A clear understanding of the meaning of these terms and their limitations is essential to an understanding of the results of the investigation.

The location of an earthquake is generally given as the epicenter of the earthquake. This is a point on the earth's surface vertically above the hypocenter or focus of the quake. The latter is the point from which the shock waves first emanate. However, as discussed, above, earthquakes originate from faults. These are surfaces not points, so the hypocenter is only one point on the surface (or volume) that is the source of the earthquake.

Magnitude describes the size of the earthquake itself. Technically, it is defined as the logarithm of the maximum amplitude recorded on a standard seismograph at 100 kilometers (62 miles) from the epicenter. The most important part of this definition is that it is a logarithmic scale and an increase of one in magnitude (e.g., magnitude 5.0 to 6.0) represents an increase of 10 in the amplitude of the recorded wave. It should also be noted that the magnitude of an earthquake is determined at a considerable distance from the epicenter of the earthquake, and that it is based on ground displacement rather than ground acceleration.

Intensity describes the degree of shaking in terms of the damage at a particular location. The scale used today is the Modified Mercalli Scale, and is composed of 12 categories (I to XII) of damage as described in Table 1. The Roman numerals are used to emphasize that the units in the scale are discrete categories rather than a continuous numerical sequence as is the magnitude scale. It is important to remember that intensity is a very general description of the effects of an earthquake, and depends not only on the size of the quake and the distance to its center but also on the quality of the construction that has been damaged and the nature of local ground conditions.

3. Occurrence and Recurrence of Earthquakes

Earthquakes have had in the past a certain occurrence in space and time. These occurrences may or may not set certain patterns that can form the basis for predicting their occurrence in the future. When such occurrences are analyzed in time, certain characteristics may statistically recur at definite intervals. If it can be shown that a particular magnitude earthquake recurs on a fault on the average of a certain number of years, this number can be said to be the recurrence interval for the magnitude. If the interval of time is set (e.g., a 100-year period), then earthquakes of a particular magnitude will recur a certain number of times in the specified period.

TABLE 1. MODIFIED MERCALLI INTENSITY SCALE OF 1931
(from United States Earthquakes)

Intensity	Description of Damage
I	Not felt except by a very few under specially favorable circumstances. (I Rossi-Forel Scale)
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. (I to II Rossi-Forel Scale)
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated. (III Rossi-Forel Scale)
IV	During the day, felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably. (IV to V Rossi-Forel Scale)
V	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. (V to VI Rossi-Forel Scale)
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight. (VI to VII Rossi-Forel Scale)
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerably in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars. (VIII Rossi-Forel Scale)
VIII	Damage slight in specially designed structures; considerable in ordinary, substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed. (VIII to IX Rossi-Forel Scale)
IX	Damage considerable in specially designed structures; well-designed, frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. (IX Rossi-Forel Scale)
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with their foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. (X Rossi-Forel Scale)
XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into air.

In California, as in most large areas, small earthquakes occur much more often than large earthquakes. Also, there is a fairly definite pattern in that the logarithm of the number of events of a particular magnitude that have occurred in the past is approximately proportional to the magnitude of those events. This relationship appears to apply to larger areas such as California and western Nevada, some smaller areas such as the Los Angeles Basin, and to some faults such as the Newport-Inglewood. However, this relationship does not apply to all faults, and it should be applied to small areas, such as cities or individual sites, with great care.

B. ENGINEERING CHARACTERISTICS OF EARTHQUAKES

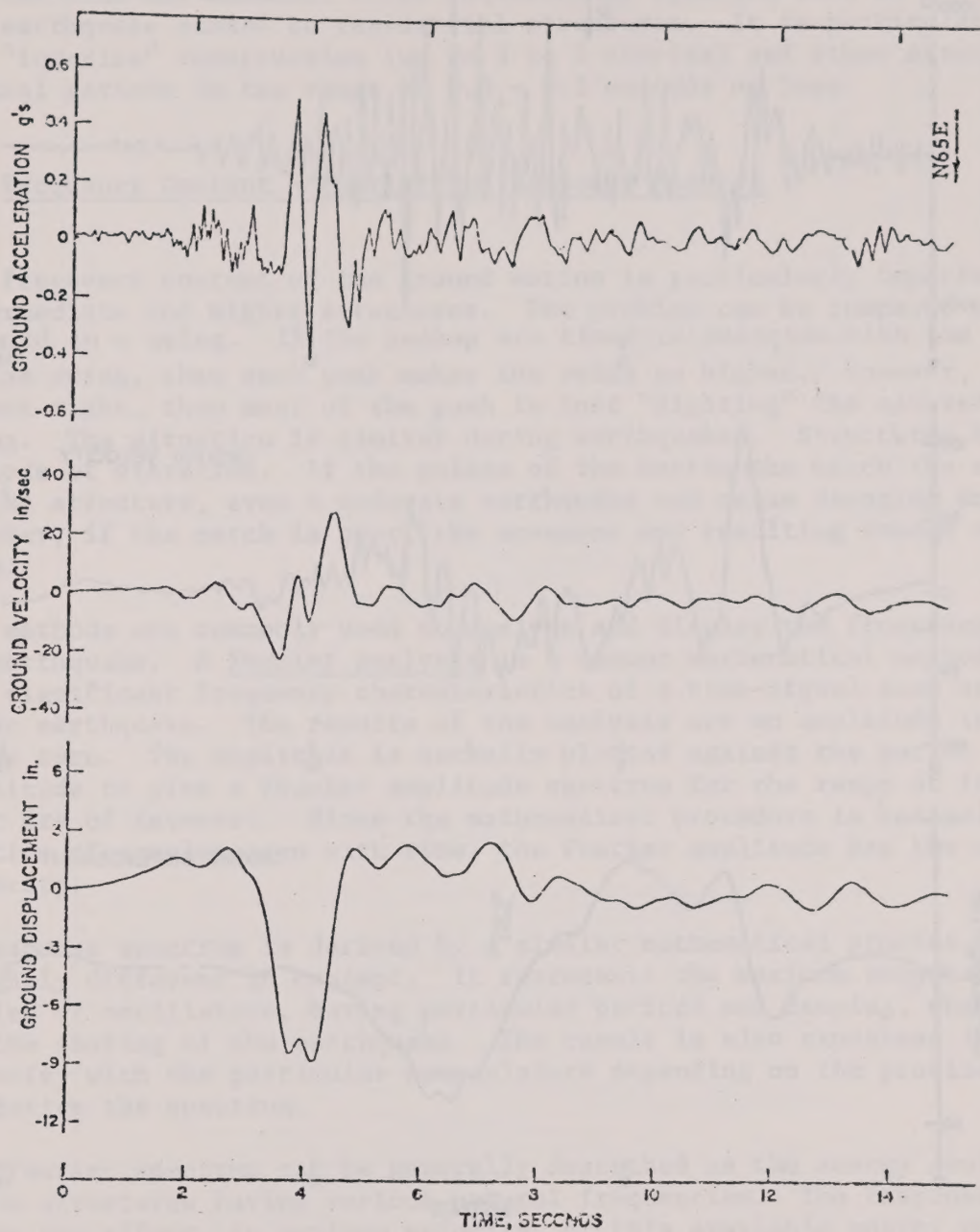
The data of seismologists and geologists are, in general, not applicable to the engineering design of earthquake-resistant structures. The seismograph, for example, is a very sensitive instrument designed only to record earthquakes at great distances. A level of shaking that would be meaningful to an engineer in designing a building would put most seismographs completely off-scale.

As a result, it has been necessary to design and install special instruments to record the strong motions of earthquakes that are of interest to the engineer in the design of earthquake-resistant structures. The first such instruments, principally accelerographs and seismoscopes, were installed by the U.S. Coast and Geodetic Survey in the late 1920's and the 1933 Long Beach earthquake was the first real test of the system. The motions were apparently stronger than expected, and the accelerograph record from Long Beach itself has never been adequately deciphered. Since that time, the instrumentation and analytical techniques have been continuously improved, and many excellent records have been obtained of the more recent strong earthquakes.

The following sections are a brief introduction to the concepts, data, and application of strong-motion records. The science is relatively young, and tends to grow in bursts following the recording of a damaging earthquake.

1. Acceleration, Velocity, and Displacement

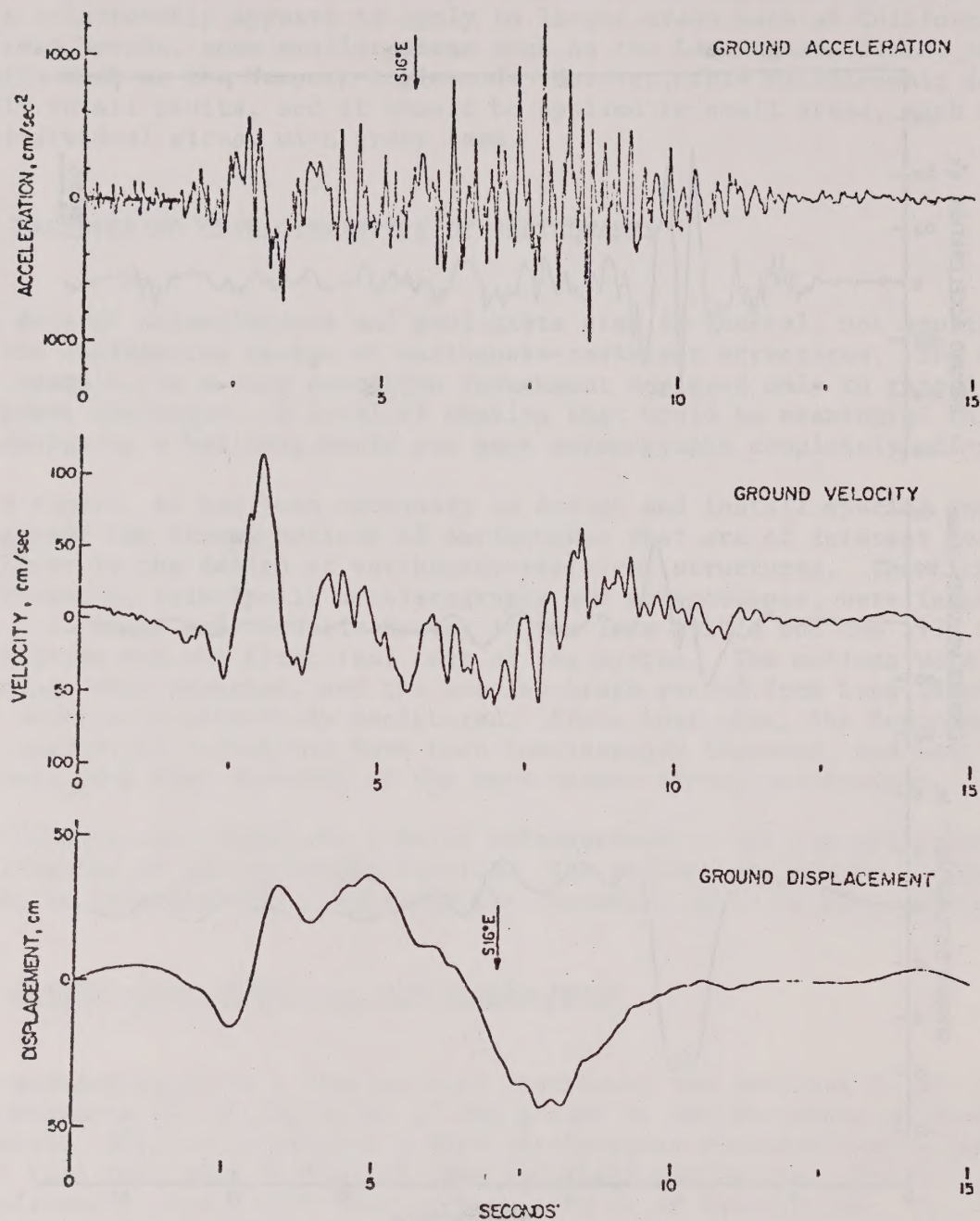
The accelerograph is a short-period instrument (in contrast to the seismograph), and measures the acceleration of the ground or the structure on which it is mounted. Figure 1 shows the ground acceleration recorded just a few hundred feet from the fault during the 1966 Parkfield earthquake. The velocity and displacement curves have been derived from it by integration. It is a particularly good example of the relationships of these three parameters of motion because of the relatively "clean", single-displacement pulse that corresponds to two velocity peaks and four acceleration peaks. Figure 2 shows the more typically complex record of the San Fernando earthquake as recorded at Pacoima Dam. Neither of the two, however, are typical records in terms of accelerations recorded. The Pacoima record shows the largest acceleration recorded to date (1.25g), and the Parkfield record (0.5g) was the largest before the San Fernando earthquake.



Station 2 N65E Motion.

Figure 1.

from Housner & Trifunac, 1967



Acceleration, velocity and displacement in the S16°E direction during the main event of the San Fernando earthquake of February 9, 1971, 06:00 (PST).

Figure 2.

from Trifunac & Hudson, 1971

It should also be noted that accelerographs normally record three components; two in the horizontal plane at right angles to each other, and one vertical. Only one component is shown in each of the two examples.

Maximum acceleration is one of the basic parameters describing ground shaking, and has been the one most often requested by agencies such as FHA in determining the earthquake hazard to residential structures. It is particularly important for "low-rise" construction (up to 3 to 5 stories) and other structures having natural periods in the range of 0.3 - 0.5 seconds or less.

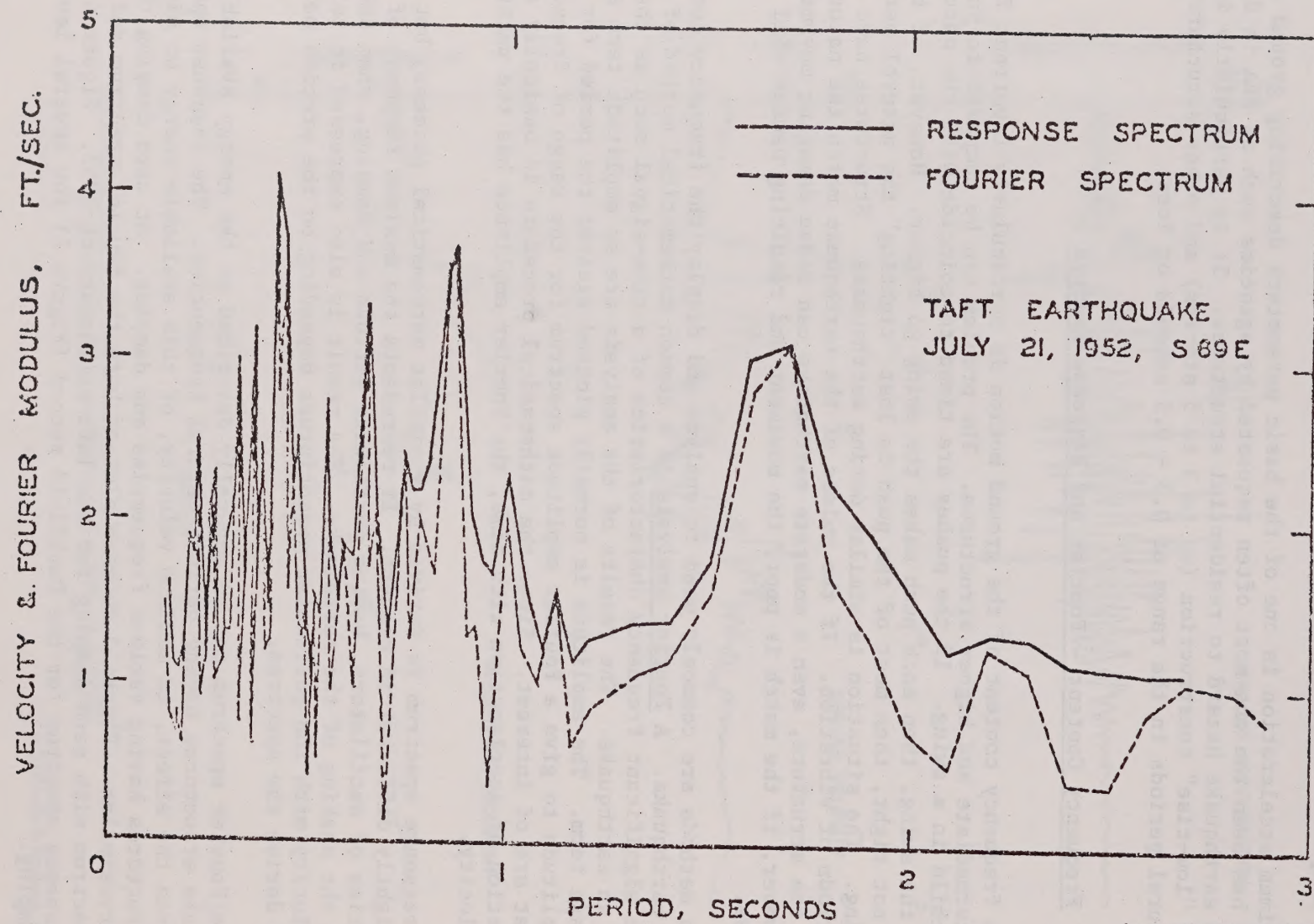
2. Frequency Content - Fourier and Response Spectra

The frequency content of the ground motion is particularly important for the intermediate and higher structures. The problem can be compared to pushing a child in a swing. If the pushes are timed to coincide with the natural period of the swing, then each push makes the swing go higher. However, if the timing is not right, then most of the push is lost "fighting" the natural period of the swing. The situation is similar during earthquakes. Structures have certain periods of vibration. If the pulses of the earthquake match the natural period of the structure, even a moderate earthquake can cause damaging movement. However, if the match is poor, the movement and resulting damage will be much less.

Two methods are commonly used to analyze and display the frequency content of an earthquake. A Fourier analysis is a common mathematical method of deriving the significant frequency characteristics of a time-signal such as the record of an earthquake. The results of the analysis are an amplitude term and a phase term. The amplitude is normally plotted against the period for that amplitude to give a Fourier amplitude spectrum for the range of frequencies that are of interest. Since the mathematical procedure is basically an integration of acceleration with time, the Fourier amplitude has the units of velocity.

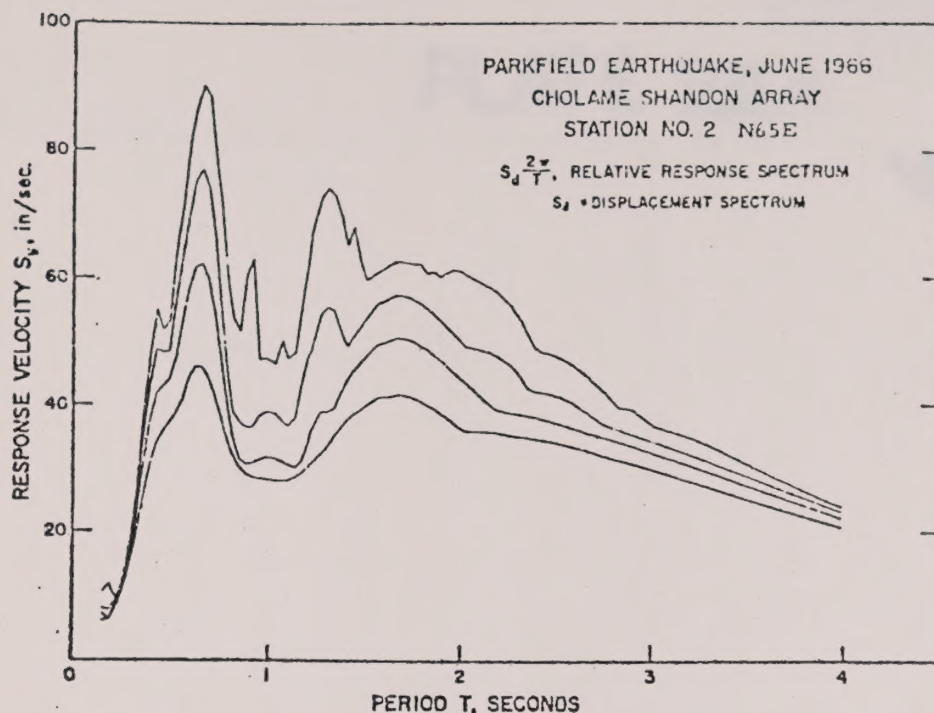
A response spectrum is derived by a similar mathematical process, but is slightly different in concept. It represents the maximum response of a series of oscillators, having particular periods and damping, when subjected to the shaking of the earthquake. The result is also expressed in terms of velocity with the particular nomenclature depending on the precise method used to derive the spectrum.

The Fourier spectrum can be generally described as the energy available to shake structures having various natural frequencies. The response spectrum gives the effect, in maximum velocity, of this available energy on simple structures having various frequencies and damping. At zero damping the two are very similar. Figure 3 shows a plot of both the Fourier spectrum and the response spectrum with zero damping for the Taft earthquake of 1952. Figure 4 shows the response spectrum for the Parkfield record (Figure 1) for several levels of damping.



from Alford et al, 1964

Figure 3



Response Spectra, Station 2-N65E. The curves are for 0, 2, 5 and 10% damping

Figure 4

from Housner & Trifunac, 1967

3. Near-Surface Amplification

The shock waves of an earthquake radiate outward from the source (i.e. the slipped fault) through the deeper and relatively more dense parts of the earth's crust. In this medium, the waves travel at high velocity and with relatively low amplitude. However, as they approach the surface, the velocity of the medium decreases and may become quite variable if layers of different rock types are present. The overall effect is generally an amplification of the wave or of certain frequencies within the spectrum of the wave.

The most consistently applicable effect is the increase in wave amplitude that accompanies the decrease in velocity. This relationship can be compared to laws of mechanics that require the conservation of energy and momentum. In the case of earthquake waves, the energy of velocity is transferred to energy of wave amplitude when the velocity decreases.

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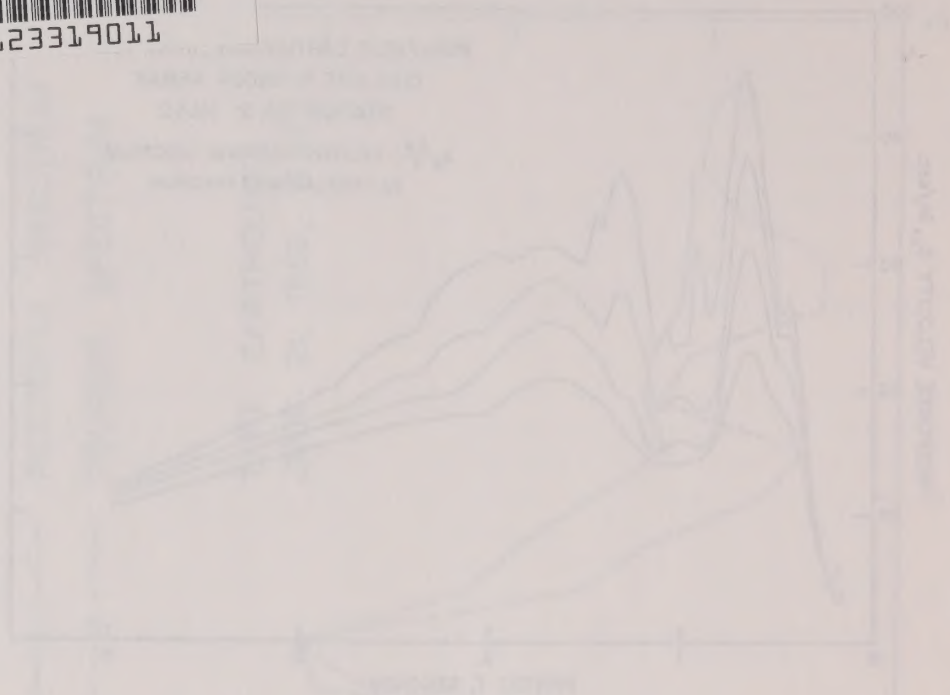


Figure 4. The curves show the variation of the ratio of the area under the curve to the total area under the curve for the different values of the parameter α .

2. Theoretical Analysis

The shape of an arbitrary probability density function (PDF) is determined by the shape of the underlying random variable. In this paper, we consider the case of a random variable which is the sum of a large number of independent and identically distributed (i.i.d.) random variables. The central limit theorem (CLT) states that the distribution of the sum of a large number of i.i.d. random variables approaches a normal distribution. However, the CLT is only valid for the case of a large number of i.i.d. random variables. In this paper, we consider the case of a small number of i.i.d. random variables. The distribution of the sum of a small number of i.i.d. random variables is not normal. The distribution of the sum of a small number of i.i.d. random variables is determined by the shape of the underlying random variable. In this paper, we consider the case of a small number of i.i.d. random variables. The distribution of the sum of a small number of i.i.d. random variables is determined by the shape of the underlying random variable.

The most commonly used method for determining the shape of the underlying random variable is the method of moments. This method involves calculating the moments of the random variable and comparing them to the moments of a normal distribution. If the moments of the random variable are significantly different from the moments of a normal distribution, then the random variable is not normal. In this paper, we use the method of moments to determine the shape of the underlying random variable. We calculate the first four moments of the random variable and compare them to the moments of a normal distribution. The results show that the random variable is not normal.

EXPLANATION

FLOOD INUNDATION

— APPROXIMATE BOUNDARY OF 100-YEAR FLOOD PLAIN

INUNDATION FROM DAM FAILURE

— LITTLE LAKE DAM INUNDATION AREA

— LAKE HEMET DAM INUNDATION AREA

T:38 ELAPSED TIME IN MINUTES FROM DAM FAILURE TO ARRIVAL OF "FIRST WATER"

SCALE
0 .5 1
miles

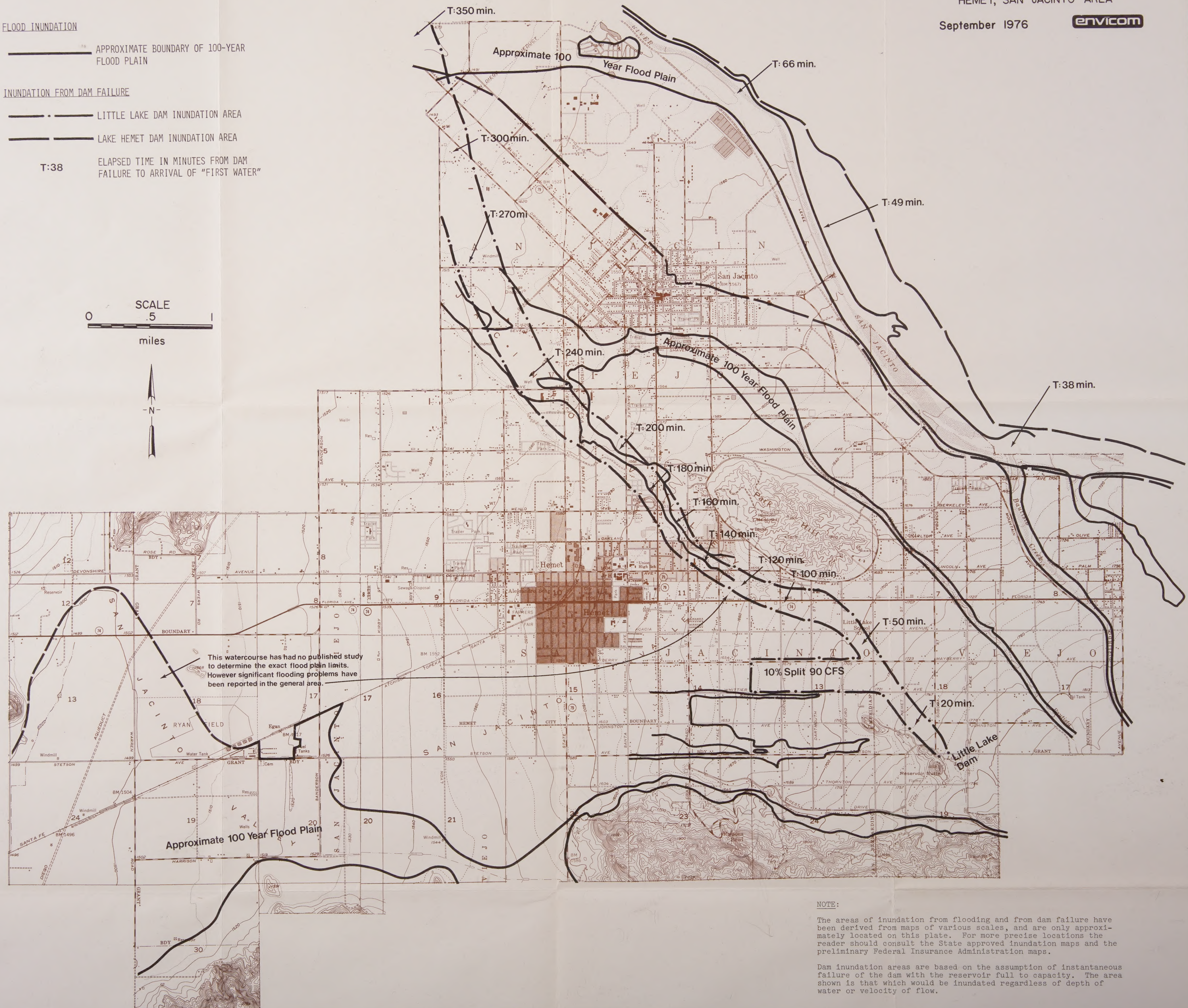
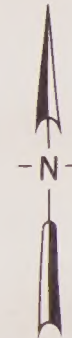


PLATE VIII B SAFETY ELEMENT MAP

HEMET, SAN JACINTO AREA

September 1976

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EXPLANATION

FAULTING

- Active or potentially active fault; dashed where approximate; dotted where buried.
- Boundary of Special Studies Zone (Alquist-Priolo Act) as defined by State Geologist. Note: These boundaries and the faults within are included for informational purposes only. Precise location should be taken from the maps issued by the State.
- Location of trench excavated to delineate fault showing initials of author and date of report. Findings annotated as follows:
- FC - Fault confirmed
 - NF - No fault encountered
 - FM - Fault location modified
 - FS - New fault suggested

SECONDARY HAZARDS

LIQUEFACTION:

Depth to (top) and elevation of (bottom) groundwater during 1971-72 season.

SLOPE INSTABILITY:

Ground shaking zones modified as follows to indicate degree of slope instability:

- 0 - Nil
- 1 - Very low
- 2 - Low
- 3 - Moderate
- 4 - High (probable landslide)

GROUND SHAKING



- Boundary of ground shaking zone based on distances to causative fault.
- Boundary of ground shaking zone based on soil and/or rock conditions.
- A Bedrock (weathered)
 - B Alluvium of intermediate thickness (200-2000')
 - C Thick alluvium and soft sediments (2000'+)
 - D Thin Pleistocene alluvium (10-200')
 - E Thin Recent alluvium (10-200')

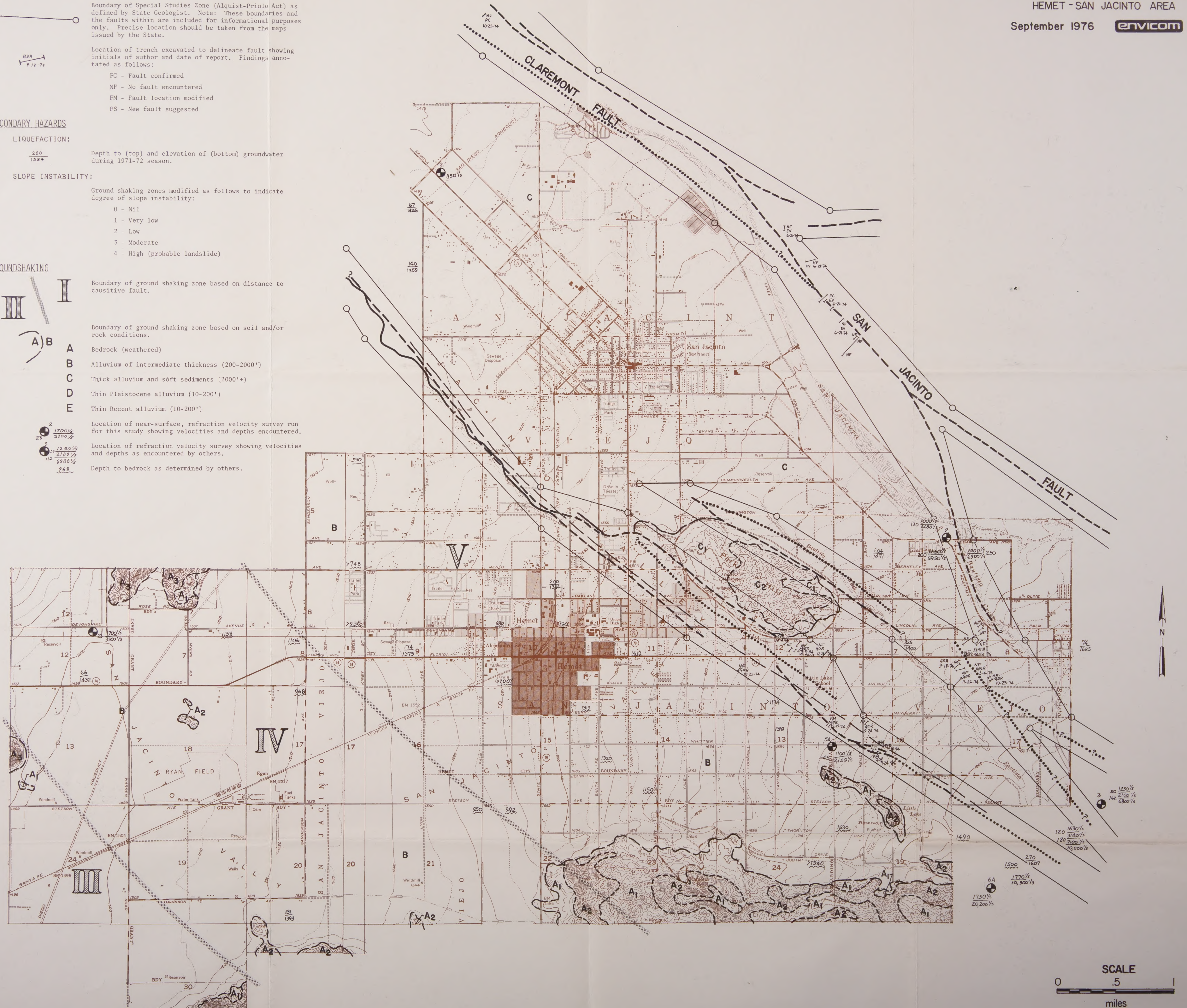
- Location of near-surface, refraction velocity survey run for this study showing velocities and depths encountered.
- Location of refraction velocity survey showing velocities and depths as encountered by others.
- Depth to bedrock as determined by others.

PLATE VIII SEISMIC HAZARDS MAP

HEMET - SAN JACINTO AREA

September 1976

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PHYSICAL, ECOLOGICAL and SOCIAL SCIENCE CONSULTANTS

4521 Sherman Oaks Avenue • Sherman Oaks, California 91403 • Telephone (213) 986-4203